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UNIVERSITY OF ILLINOIS BULLETIN

Issued Weekly

Vol. XIII August 28, 1916 No. 52

[Entered as second-class matter December 11, 1912, at the post office at Urbana, Illinois, under the Act of August 24, 1912.]

The Graduate School

of the

University of Illinois

1916-1917

Published by the University
Urbana, Illinois

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THE GRADUATE SCHOOL

OF THE

UNIVERSITY OF ILLINOIS

Announcement for
1916-1917

PUBLISHED BY THE UNIVERSITY
URBANA, ILLINOIS

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*Resigned, August, 1916.

THE UNIVERSITY CALENDAR
1916-1917

As Applicable to the Graduate School

FIRST SEMESTER, 1916-1917

1916	
Sept. 18, 19, Monday, Tuesday	Registration days
Sept. 20, Wednesday, 8 a. m.	Instruction begun
Nov. 6, Monday, 5 p. m.	Latest day for announcement of subjects for graduate theses
Nov. 30, Thursday	Thanksgiving Day
Dec. 3, Sunday	Illinois Day
Dec. 21, Thursday, 11 a. m.	Holiday recess begun
Dec. 30, Saturday, 5 p. m.	Latest day for submission of outlines of theses by candidates for professional degrees in engineering
1917	
Jan. 3, Wednesday, 1 p. m.	Instruction resumed
Jan. 25, Thursday	Semester examinations begun
Feb. 1, Thursday	Semester examinations ended

SECOND SEMESTER, 1916-1917

Feb. 5, 6, Monday, Tuesday	Registration days
Feb. 7, Wednesday, 8 a. m.	Instruction begun
Feb. 12, Monday	Lincoln Day
Mar. 31, Saturday, 5 p. m.	Latest day for filing of completed theses by candidates for professional degrees in engineering
April 5, Thursday, 12 m.	Easter recess begun
April 10, Tuesday, 12 m.	Instruction resumed
May 12, Saturday, 12 m.	Latest day for receipt by the Dean of the Graduate School of certified copies of doctors' theses
May 31, Thursday, 8 a. m.	Final examinations begun
June 2, Saturday, 12 m.	Latest day for receipt by the Dean of the Graduate School of certified copies of masters' theses
June 7, Thursday	Final examinations ended
June 10, Sunday	Baccalaureate address
June 12, Tuesday	Alumni Day
June 13, Wednesday	Forty-sixth Annual Commencement

THE EXECUTIVE FACULTY

Edmund Janes James, Ph.D., LL.D President of the University.

David Kinley, Ph.D., LL.D., *Professor of Economics and Dean.*
William Chandler Bagley, Ph.D., *Professor of Education.*
Albert Pruden Carman, A.M., Sc.D., *Professor of Physics.*
Julius Goebel, Ph.D., *Professor of Germanic Languages.*
George Alfred Goodenough, M.E., *Professor of Thermodynamics.*
Harry Alexis Harding, Ph.D., *Professor of Dairy Bacteriology.*
Harrie S. V. Jones, Ph.D., *Assistant Professor of English.*
Laurence Marcellus Larson, Ph.D., *Professor of History.*
Herbert Windsor Mumford, B.S., *Professor of Animal Husbandry.*
William Abbot Oldfather, Ph.D., *Professor of Classics.*
Arthur Newell Talbot, C.E., *Professor of Municipal and Sanitary Engineering.*
Edgar Jerome Townsend, Ph.D., LL.D., *Professor of Mathematics.*
Henry Baldwin Ward, Ph.D., *Professor of Zoology.*
Edward Wight Washburn, Ph.D., *Professor of Physical Chemistry.*
Charles Maxwell McConn, A.M., *Registrar, Secretary of the Faculty.*

HISTORY AND ORGANIZATION

Although for many years the University of Illinois had offered advanced students facilities for study and research in various lines, graduate work was undertaken under the name of the Graduate School for the first time in 1892. In 1894 the administration of the school was vested in the Council of Administration, and the Vice-President of the University became Dean of the School. In 1906 the Graduate School was organized as a separate faculty, consisting of a dean and members of the University faculty assigned to this duty by the President.

By act of the Trustees the teaching faculty of the Graduate School includes all members of the University faculty who give instruction in approved graduate courses. The affairs of the School, however, are in charge of the executive faculty appointed each year by the President.

ADMISSION

Admission to the Graduate School may be granted to graduates of institutions whose requirements for the bachelor's degree are substantially equivalent to those of the University of Illinois, and to applicants from other institutions approved by the Executive Faculty, as hereinafter provided. *Admission to the Graduate School does not, however, imply admission to candidacy for an advanced degree, and gives no right or claim to be so admitted. Such candidacy is determined by the Faculty after the student has demonstrated by his work here, for from two to five months, that he has the ability to do major work of graduate character. A mere accumulation of "credits" or "grades" is not sufficient.*

A graduate of an institution meeting the requirements of a standard college, as described below, may be admitted to the Graduate School, provided he satisfies the Dean and the departments concerned that he will be able to proceed to the master's degree in a period not exceeding two years.

For purposes of admission to the Graduate School a *standard college* is one which meets the following requirements:

a. The college shall require four years' work of collegiate grade for graduation, based upon an entrance requirement of at least fourteen standard high school units.

b. If conditioned students are admitted, they shall not be allowed to proceed beyond the sophomore year without removing their conditions.

c. The college shall maintain at least six departments in liberal arts and sciences, each having at least one professor in each department giving his entire time to the college work of his department.

d. The minimum educational attainment of college professors shall be equivalent to graduation from a college of high grade and graduate work equivalent at least to that required for a master's degree from the University of Illinois.

e. The college shall have a productive endowment sufficient to yield a net annual income of at least $10,000 available for instructional purposes in the college. If the institution offers courses in addition to the usual liberal arts course, it shall have a correspondingly larger annual income.

f. The college shall have library and laboratory equipment sufficient to meet fully the needs of the courses announced.

g. In addition to the foregoing specific requirements, so far as possible the general standing of the college shall be considered, including: the character of its curriculm, the efficiency of its instruction, the number of hours of instruction required of the members of its faculty, the size of the classes, the general standards for graduation, its conservatism in granting degrees based upon work done *in absentia,* the success of its graduates in the Graduate School of this University and elsewhere, etc.

Unless otherwise specially permitted, a student enrolled in the Graduate School must take each semester at least one course accepted by the executive faculty for credit in a major or a minor subject.

Admission to particular graduate courses or departments may be granted only to those who have had the requisite undergraduate work in those courses or departments. But a student of mature age who satisfies the Dean and the department concerned of his ability to pursue graduate work in a given line may be enrolled in particular graduate courses, and permitted to carry on such study or investigation under the direction of a department of the University as the department shall recommend and the Dean approve.

Application blanks for admission may be secured from the Dean of the Graduate School or from the Registrar of the University. Every applicant must submit with his application for admission, an official transcript of his college record.

REGISTRATION AND PROGRAM OF STUDY

The following regulations concerning registration and program of studies are laid out primarily for first year students. Second and third graduate students fill out their programs irrespective of unit value of courses, according to their needs, under the advice of their instructors.

Registration.—Each graduate student must register when he first connects himself with the University, and afterwards at the beginning of each semester.

Registration of a new student may be accepted at any time provided the student is prepared to take up courses actually under way. Credit towards the fulfillment of the residence requirement dates, however, from the time of registration and not from the beginning of the semester or year in which the student enters. But registration will not be permitted later in the year than April 1st, except in the case of students who expect to continue through the summer session, or are returning to complete a year's work which has been broken into by illness or other unavoidable interruption.

The first registration, however, or that upon entrance, is permitted only after the student's application for admission to the Graduate School, setting forth his educational attainments, has been duly approved.

A new student must fill out in duplicate an application for admission and submit it to the registrar, from whom he will receive a card of admission and a study blank. He should fill out the study blank after consultation with his adviser, or the person in charge of his major work, and also with the instructors whose courses he wishes to elect. His registration must be completed within two weeks. Otherwise it is subject to a fee of one dollar.

Registration of any student who was enrolled in the preceding semester will not be permitted after two weeks from the opening of class work for the current semester, except by vote of the faculty. Registration after this date is also subject to a fee of one dollar.

Changes in Study Lists.—A graduate student is expected to plan his work so carefully that changes in his study list during the semester will not be necessary. When a change seems advisable, however, it may be permitted without fee if made within three weeks of the date of registration. After that date a fee of one dollar is charged for each change, except that the total charge for a rearrangement authorized on any one change slip shall not exceed two dollars.

Advisers.—The person in charge of the major work of the student becomes his adviser, and, together with those with whom the student is taking first and second minor courses, forms a committee with general supervision over the student's general course of study. This committee is expected to follow the student's work and see that he is helped to lay out an intelligently planned course, and to give him such advice as may be necessary concerning his scholastic career.

Amount of Work.—Each student is required to attend a minimum of four class, lecture, or laboratory exercises per week in the first year of his graduate study; and in no case is he permitted during his course to attend more than twelve per week.

Each first year student doing full work must take at least four unit courses, and may be required to take five. A unit course is one which requires ten hours of time per week through one semester, irrespective of the mode of distribution of that time in class work, laboratory work and private study. Four such courses or their equivalent constitute a full minimum program for one semester, and eight such courses, or their equivilent, of graduate grade, constitute the minimum formal year's work required for a master's degree. Five and ten are the maximum for one semester and the year, respectively.

Therefore, registration for full work for the master's degree ordinarily provides for three unit courses, or their equivalent, per semester, in addition to a thesis, the time devoted to the thesis being ordinarily reckoned as equivalent to that for one unit course, or ten hours of time a week, and may not exceed one-third of a full minimum program. If a student is excused from writing a thesis he must take four unit courses or their equivalent.

Undergraduate Courses Open to Graduate Students.—Courses to which sophomores are regularly admitted may not be taken for graduate credit, either major or minor.

Unless otherwise specified by the department concerned, a course for graduates and advanced undergraduates, not open to students below senior grade and counting four or five hours of undergraduate credit, if taken by graduate students, will be treated as a unit course; when counting less than four hours of undergraduate credit, such a course, if taken by graduate students, will be treated as a half-unit course.

Unless otherwise specified by the department, a course the prerequisites of which are such as to make it possible for juniors to be admitted, if taken by a graduate student, is counted as a half-unit course or a quarter-unit course, according to the number of hours of undergraduate credit for which the course is given.

Transfer of Undergraduate Credit.—No credit earned during the undergraduate course shall be transferred for graduate credit, unless such credit was earned in time additional to the time normally required for the bachelor's degree, in the second semester of senior year, and then only for minor subjects.

Failures.—A graduate student who fails in his major subject cannot acquire his degree in that same year. No condition examinations are given graduate students.

Miscellaneous and Listener's Courses.—Graduate students are permitted under proper circumstances to attend classes as listeners, and to elect miscellaneous subjects, that is, courses which do not count towards an advanced degree. Listeners' cards may be obtained at the Dean's office. Under the authority conferred by the faculty on the Dean no student will be permitted by the Dean to visit more than one class or to take more than one miscellaneous subject, nor is any subject open as a listener's or miscellaneous course unless it has a specific educational bearing on the student's major or minor subjects of study.

A student who elects a miscellaneous course is required to register in it, do the work, and pass the semester examinations. A student who has a listener's card is not permitted to participate in the classwork or the examination.

No student may register for full minimum program of work for graduate credit if it is necessary for him to carry at the same time more than one miscellaneous subject and to visit one course.

Students On the Staff.—Assistants and others on the University staff who undertake to do graduate work are permitted to take an amount of work determined by the terms of their employment. Such a student, applicant for a master's degree, must ordinarily stay through at least two years. In no case will the doctor's degree be conferred upon an applicant otherwise fit in less than four years if he is on the staff in any capacity.

The enrollment of a number of the staff is subject to the approval of the officer to whom he is responsible as a member of the staff and of the dean of the Graduate School with reference to the amount of work to be taken. Before credit shall be recorded for such graduate student at the end of a semester, the head of the department in which he is employed, or someone authorized by the head, must certify that the time given to graduate work by the student has not impaired the work for which he is paid by the University.

Residence and Work Done Elsewhere.—Continuous residence and study are required of all members of the Graduate School, unless they are granted leave of absence by the Dean, upon recommendation of the professor in charge of their work, for the purpose of carrying on elsewhere studies or investigation in the line of work for their degrees.

The term "year's residence" means a full year's work of at least eight units done during two semesters.

Students should note that all the work for the master's degree must be done in residence at the University, excepting in the case of members of the staff who have spent half of their time in study through a year at some other institution, and then do the rest of the work required during a year's residence here. Credit for work done elsewhere is not "transferred." The candidate is examined here on all the work required for the degree.

Withdrawal.—If after registration a graduate student wishes to withdraw from any course or to add other work, or if he wishes to withdraw altogether from the University, he should first secure the necessary papers from the Dean's office.

CHARACTER OF GRADUATE WORK

The principal aim of graduate study is the development of the power of independent work and the promotion of the spirit of research. Each candidate for a degree is expected to have a wide knowledge of his subject and of related fields of work; for the graduate student is not expected to get from lecture and laboratory courses all the knowledge and training necessary to meet the requirements for his degree.

Students, especially candidates for the doctor's degree, are warned against restricting themselves to the courses prescribed or suggested by the departments in which they are studying. Each student is expected to do a wide range of private reading and study, and in many cases will find it advisable to take one or more courses of lectures quite outside the field of his chosen subject.

DEGREES

Attendance at Commencement is required of all candidates for degrees.

The Master's Degrees.—The master's degree conferred depends upon the character of the bachelor's degree. The usual practice is that A.M shall follow A.B., that M.S. shall follow B.S. However, this practice may be departed from in cases where the undergraduate course of study of the candidate was of a kind for which some reputable institutions in this country give A.B., while others give B.S. Such departure from the regular practice is permitted, however, only on an individual petition duly approved.

Amount of Work Required.—Candidates for the degree of Master of Arts or Master of Science are required to do at least one year's work in residence and to write a thesis. By one year's work is meant from four to five unit courses each semester, or their equivalent, but the completion of the required number is not of itself sufficient to insure the student's receiving his

degree. A failure in any subject, or an absence from examination in any subject may prevent the conferring of his degree; and, as already indicated, failure in any course in the major field precludes the conferring of the degree in that year.

Majors and Minors.—A candidate for a master's degree may do all his work in one subject, or he may select a major and one minor, or a major and two minors. A major or minor denotes the field of knowledge of a department, or such part thereof as constitutes a separate and independent division of that field. For a master's degree a major is at least half the work, or a minimum of four units, for one year. If a student is taking two minors, the first is a minimum of two and a maximum of three units. A second minor: a minimum of one and a maximum of two units. If he has only one minor, it must be not less than two units.

A program of studies for a first year graduate student which is limited exclusively to the investigation of a single problem will not be approved. Less than one unit may not be counted as satisfying the requirements of a minor for a master's degree without the approval of the student's adviser and of the department concerned.

Master's Thesis.—Each candidate for a master's degree is also required to present a thesis on some subject approved by the professor in charge of his major work and the faculty of the School. The requirement of a thesis may be waived, however, upon the recommendation of the head of the department in which the student is doing his major work, and the approval of the Dean, provided application to waive the thesis is made at the beginning of the year. *In no case will permission to take the degree without the thesis be given by the Dean if applied for later than the latest date for the approval of thesis subjects, as shown by the calendar.*

No one will be excused from writing a thesis unless one-half of his program of studies consists of courses numbered 100 upwards.

The thesis required from a candidate for a master's degree ordinarily will demand one-fourth of the student's time and may not exceed one third of it. The thesis must be typewritten, on "thesis paper," and the title-page must be printed. The thesis in its final form, together with a certificate of approval by the proper officer, must be left by the professor in charge at the Dean's office at the time set in the calendar. No article prepared for another use, or previously published, will be accepted as a thesis.

Graduate Study in the Summer.—1. Attendance upon four summer sessions of nine weeks each, or one semester and two summer sessions of nine weeks each, is considered the equivalent of one year in residence. If in these sessions the required amount of work is properly done a master's degree may be earned in this way. The faculty is unwilling to accept summer session work beyond the master's degree toward the doctor's degree, excepting in the case of a student who works in a summer session preceding or following a regular year's attendance at the University. In no case may the last year's work for the doctorate be done in disconnected summer sessions.

2. No course offered in the summer session may be taken for credit to-

wards a higher degree unless it is specially described in the summer session circular as accepted for that purpose.

3. Graduate students in the summer session are credited with only 8 weeks towards the fulfillment of the time requirement for the master's degree. It is necessary therefore for those who take work through four summer sessions for this degree to complete the residence requirement of four additional weeks. This may be done at any summer session by continuing work after the close of the regular session, under the direction of the instructor with whom the student is working. The student is examined on the work thus done as on all other work, and must report his additional work to the Dean.

4. Graduate courses in medical sciences are offered in the summer quarter between June and September at the College of Medicine of the University of Illinois in Chicago. Circulars describing the courses offered and conditions of admission and work may be obtained from the Secretary of the College of Medicine, Congress and Honore Streets, Chicago.

Marine Biological Laboratories.—Students in zoology, candidates for the master's degree, part of whose necessary preparation is experience in a marine or fresh-water biological laboratory or station, are permitted to offer in part fulfillment of the requirements for the master's degree, work done in such fresh-water or marine laboratory; provided that the student who wishes to have such work accepted make application before beginning work in such laboratory; that the selection of the laboratory at which he is to work has been approved by the faculty beforehand; that the time to be spent in such work shall not be less than six nor more than nine weeks in any one summer; that the instructors under whom the student is to work have been previously accepted by this faculty; that he submit to an examination here on the work done at such laboratory, and that a certificate of attendance from a proper officer of the laboratory or station be submitted and a full written report of the work done in the shape of notes, or otherwise, be required; and that the student shall be in residence here at the University for one full academic year during which he shall do the rest of the work necessary for his degree.

The marine biological laboratories which have thus far been approved as institutions at which students of this University may take work for record here are:

Marine Stations: Marine Biological Laboratory, Woods Hole, Massachusetts. Harpswell Marine Laboratory, Casco Bay, Maine.

Puget Sound Station, Friday Harbor, Washington.

Hopkins Marine Laboratory of Stanford University, Pacific Grove California.

Scripps Institute for Biological Research, University of California, LaJolla, California.

Carnegie Institution Laboratory, Dry Tortugas, Florida.

Bermuda Biological Station, Bermuda.

Fresh Water: Douglas Lake Station, University of Michigan, Topinadee, Michigan.

Ohio State University Laboratory, Cedar Point, Ohio.

Master's Degrees in Engineering

Two classes of second degrees are open to graduates of the College of Engineering, namely, academic and professional.

The academic second degree in engineering is Master of Science, following Bachelor of Science, in Architecture, Architectural Engineering, Civil Engineering, Electrical Engineering, etc. This degree is conferred in accordance with the regulations described above for *academic work in residence only.*

The *professional* second degrees in Engineering are as follows:

Master of Architecture after B.S. in architecture.

Architectural Engineer after B.S. in architectural engineering.

Civil Engineer after B.S. in civil engineering or B.S. in municipal and sanitary engineering.

Electrical Engineer after B.S. in electrical engineering.

Mechanical Engineer after B.S. in mechanical engineering.

Engineer of Mines, Civil Engineer, Electrical Engineer, or Mechanical Engineer, after B.S. in mining or railway engineering, according to the course.

Professional degrees are conferred upon two classes of candidates: (1) graduates of the College of Engineering of the University of Illinois who have been engaged in acceptable professional work away from the University for a period of not less than three years after receiving the degree of Bachelor of Science; (2) graduates of the University of Illinois, or of institutions of equal standing, who have been engaged in acceptable professional work in residence at the University for a period of not less than three years after receiving the degree of Bachelor of Science.

In "acceptable professional work" may be included contributions to technical literature, activity in professional societies, investigation of engineering problems, and the teaching of engineering subjects.

A candidate must declare his candidacy and file with the Dean of the College of Engineering, as chairman of the committee in charge, a detailed statement covering his professional study and experience, not later than the first Monday in November preceding the Commencement at which he proposes to qualify. Prior to December 31 next succeeding, he must submit for approval an outline of his proposed thesis and he must file his completed thesis not later than April 1. If the statement of professional experience and study and the thesis are accepted, the candidate must present himself at commencement in order to receive the degree.

Candidates for professional engineering degrees who already hold the degree of Master of Science, may qualify for the professional degree after two years of professional work.

A candidate for a professional engineering degree must pay the incidental fee of twenty-four dollars on being notified that his professional study and experience are accepted as qualifying him to enter as a candidate for the degree. No one will be enrolled as a candidate for the degree at the following Commencement who does not pay his fee at this time. When a candidate for a professional engineering degree has once been accepted and paid his fee, he is eligible to receive the degree at any time within five years, without additional fee,

on completion of the requirements; provided, however, that unless he completes the requirements within two years his name will be dropped from the list of candidates and in order to receive the degree within the five-year period he must register once more.

The Degree of Doctor of Philosophy

The requirements for the degree of Doctor of Philosophy are a thorough mastery of a selected field of study, evidence of the power of independent investigation in this field, a broad knowledge of the wider field of study of which this major subject is a part, a general acquaintance with related fields of knowledge and a mastery of all branches of study which are necessary to a full knowledge of the main subject. Each student who is seeking this degree is expected to choose for study and final examination a major subject, or field of study, and a first and second minor. The major subject is the field in which the student expects to become expert and an authority. The first minor must be a subject closely related to the major and may, under certain conditions and with proper approval, be a subdivision of the major field of study. The second minor should be chosen outside of the major field of study.

When a candidate chooses any subject as his major and a division of that subject as his minor, he is not permitted to choose as a second minor any division of work in that same department, excepting by special vote of the executive faculty of the School.

For the doctor's degree no definite division can be made to hold in all cases. In general the faculty approves an arrangement which, distributing the student's time through the required three years, divides it equally among his three subjects in his first year of graduate study; in the proportion of two to one, as between his major and first minor, in the second year of graduate study (his second minor being finished and dropped at the end of the first year) ; and gives all his time to his major during his third year.

To put the matter in another way, a course of graduate grade (from among the "hundred" courses) meeting twice or three times a week, corresponding roughly to what is sometimes called a full course, or in our terminology a unit course, running through the year, should ordinarily be sufficient for a second minor; a similar course running through two years should ordinarily be sufficient for a first minor. It is understood that in each case the course of courses taken must be such as to occupy the student's full proportion of time.

The candidate's list of subjects must receive the approval of the head of the department in which he chooses his major work and of the Dean of the Graduate School.

Period of Study.—The *minimum* period of study required for securing the degree of Doctor of Philosophy is three years. The degree is conferred, however, not for residence during a certain period, but for scholarly attainments and power of investigation, as proved by thesis and examinations.

At least the first two or the last one of the three years required must be spent at this University.

Credit for work done in other universities is not "transferred." The candi-

date is examined here on the subjects offered by him for the advanced degree. However, his period of residence at another institution of proper grade may be accepted as fulfillment of the residence requirement of the University of Illinois, so far as it goes.

Preliminary Examination.—Towards the end of his second year of study, or, by special permission, at the beginning of his third year, the candidate for the degree must submit to a preliminary examination conducted by the members of the faculty with whom he is doing his principal work, in order to determine whether he will be accepted as a candidate for the degree in the following year. This examination is intended to test the student's knowledge of the fields of his major and minor subjects of study. It is partly oral, and may be wholly so.

Language Examination.—The candidate will be required to demonstrate his ability to read French and German, and other language needed for the prosecution of his work.

The examination in French and German is in charge of a committee of three, consisting of the head of the department in which the student is taking his major work, of a member of the department of modern languages, and a member appointed by the Dean of the Graduate School; this test of proficiency in the use of French and German shall take place at the time of the preliminary examination for admission to candidacy for the doctor's degree.

Final Examination.—On or before the last Monday in May of the year in which the candidate expects to come up for his degree, he must submit to a final examination. Besides the written examination set by the departments of the major and minor studies, the candidate must also take an oral examination, given by a committee appointed by the Dean. The oral examination is primarily on the research work of the student, as embodied in his thesis, but it is not confined to this. It extends to the whole field of the study of the candidate. It will not be confined to the courses which the candidate has attended in the University of Illinois only, if he has done part of the work elsewhere; nor even to the field covered by the courses specifically taken in this or other universities; but will be so conducted as to determine whether the candidate has a satisfactory grasp of his major subject as a whole, and a general acquaintance with the fields of knowledge represented by his course of study.

Before the candidate is admitted to the final examination and the defense of his thesis, he may be required to take any other examination, oral or written, that is thought proper by the various departments in which he has studied. If after having passed his preliminary examination, he fails in the third year of his study to meet the expectations of the professors in charge of his work, or in any way fails to maintain the standard of scholarship and power of research expected of him, he may be refused admission to the final examination.

The final examination in the major and minor subjects may not be divided. The examination must be taken all at one time even though it requires several sessions.

The above examinations are in addition to those in the courses for which the student is registered. These must be taken at the times for which they are set in the examination schedule.

Thesis.—The power of independent research must be shown by the production of a thesis on some topic connected with the major subject of study. The candidate is expected to defend his thesis or dissertation before the members of the faculty, or as many of them as may wish to question him about it, in connection with his final examination.

The subject of the thesis should be chosen not later than the end of the second year of study and must be submitted for formal approval by the faculty not later than the first Monday of November of the year when the degree is expected. Unless previously printed with proper authority, a typewritten copy of the complete thesis, *on thesis paper**, must be in the hands of the Dean not later than noon of the Saturday nearest the middle of May, for submission to the examining committee.

The doctor's thesis must be printed and one hundred copies deposited in the Library of the University by the candidate, not later than the first of June preceding the conferring of the degree. If it is not printed by the first of June, the student must deposit seventy-five dollars ($75) or a bond for that amount satisfactory to the Comptroller of the University and the Dean of the Graduate School. If a bond is accepted, it must be replaced at the end of one year with a cash deposit. At the end of two years, if the thesis has not then been printed by the student, the University will print such part of it as it deems best.

The cash deposit made by the student who does not print his thesis by the end of the second year after his degree is conferred becomes the property of the University, to be used for the general purpose of printing theses.

The title page of each thesis, whether typewritten or printed, must bear the words, "Submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in—(here put the major subject)—in the Graduate School of the University of Illinois." The title page must also contain the full name of the author, his previous degrees, the full title of the thesis, the year of imprint, and, if a reprint, the title, volume and statement of the pagination of the volume from which it is reprinted. Each thesis must have an appendix giving a short biography of the candidate, including the institutions he has attended, his degrees and honors, the titles of his publications, and such other matters as are pertinent.

A leaflet containing instructions for the preparation of theses may be obtained at the office of the Dean.

Doctor's Degree in Engineering.—The degree of Doctor of Philosophy in Engineering is offered in certain lines of academic graduate work of a high scholastic type in engineering science that will attract students who wish to prepare themselves as teachers, investigators and experts.

The general requirements for this degree, as to preliminary education, linguistic attainments, etc., are the same as in other lines.

The following lines of engineering science are open as majors for the present:

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*No other will be accepted by the Dean.

Engineering mechanics
Hydraulic and sanitary engineering
Steam engineering
Electrical engineering
Heating and ventilation engineering
Railway engineering
Masonry construction and structural engineering
Coal mining engineering

The first minor may be any of the above or one of the following fundamental sciences or an authorized combination of two of them:

Theoretical mechanics
Mathematics
Thermodynamics
Chemistry
Geology
Physics (Experimental or mathematical)
Zoology
Botany

The second minor should be in other than engineering subjects.

SCHOLARSHIPS AND FELLOWSHIPS

A number of fellowships and scholarships have been established by the Trustees of the University. To first year graduate students of ability and promise there are open a number of scholarships with a stipend of $250 each and freedom from tuition, incidental and laboratory fees. To second and third year graduate students, that is, those who have had one or two years of graduate study, there are open fellowships with a stipend varying from $300 to $500, with freedom from fees. The larger stipends are given only to students who are expected to take their degrees within the year. Each holder of a fellowship or scholarship must pay the matriculation fee of ten dollars, unless he holds a first degree from the University of Illinois, and also the diploma fee of five dollars on receiving his diploma.

Candidates for these scholarships and fellowships must be graduates of the University of Illinois, or of colleges or universities having equivalent requirements for bachelors' degrees.

Application must be made upon blanks to be obtained from the Dean of the Graduate School. These application forms should be sent to the Dean of the Graduate School as early as possible in February, (and not later than the last day of that month) of the academic year preceding that for which the fellowship is desired. No application will be considered if received later than March first, until after April fifteenth, the date when appointees from the first list of applicants must accept or refuse their appointments.

Persons appointed are notified on April first and must send the Secretary of the Board of Trustees notice of their acceptance or refusal by April fifteenth;

and must agree that, if accepted, the appointment will not be resigned to take a similar one in any other institution during the year for which it is awarded.

Nominations to fellowships are made upon the grounds of worthiness of character, scholastic attainments, and promise of success in the principal line of study or research to which the candidate proposes to devote himself.

For second year fellowships, adequate preparation in one foreign language, and for third year fellowships, adequate preparation in both foreign languages, is required.

Scholarships and fellowships are good for one year, but may be renewed for a second or a third year in special cases. An appointment as honorary fellow, without stipend, may be made as specified for paid fellowships in the case of any one who has shown distinguished merit in his work.

Research Fellowships in the Engineering Experiment Station

The Engineering Experiment Station is devoted entirely to research. Its purposes are the elevation of engineering education, and the study of problems of special importance to engineers and to manufacturing, railway, mining, and industrial interests.

Fourteen research fellowships have been established in the Engineering Experiment Station. These fellowships are open to graduates of approved technical schools and universities, both American and foreign. There is a stipend of $500 a year for each fellowship. Applicants to whom these fellowships are awarded are required to agree to hold them for two years, devoting a part of their time to the work of the Engineering Experiment Station. At the expiration of this period, if all requirements have been met, the degree of Master of Science will be conferred.

Application for these fellowships should be made to the Director of the Engineering Experiment Station not later than February first. Candidates must present with their applications full information concerning themselves, including any written or published papers or results of investigation.

LIBRARIES

The general University library, the library of the State Laboratory of Natural History, and that of the College of Law are all at the University in Urbana. The libraries of the School of Pharmacy and the Colleges of Dentistry and Medicine are in Chicago.

The University libraries contain 380,000 volumes, about 26,000 of which are not yet cataloged, and 86,000 pamphlets. Of these, 360,000, including the uncataloged books, are in the libraries at Urbana; the rest are in Chicago. The departments at Urbana currently receive 4,099 periodicals, while the College of Medicine and School of Pharmacy in Chicago receive 244 more.

The general library of the University is open daily, from 8 a. m. until 10 p. m. and on Sunday from 2 p. m. to 6 p. m.

The Mason Historical Library.—The valuable library of western history collected by Edward G. Mason, Esq., long President of the Chicago Historical

Society, is in the Public Library of the city of Champaign, and is accessible to University students.

The Dittenberger Classical Library.—The University possesses the library of Wilhelm Dittenberger, at one time Professor of Classical Philology in the University of Halle. This library contains 5,600 items. It includes the works of the poets and prose writers, numerous works on grammar and history of literature, and between four and five thousand dissertations and programs on special topics. There are also many works dealing with other departments of classical philology, as epigraphy, history of ancient peoples, archaeology, philosophy, history of art, geography, chronology, metric, etc.

The Heyne Library of Germanics.—The entire library of Professor Moritz Heyne of the University of Göttingen was bought by the University. It contains about 5,200 volumes. The collection is rich in the general field of German philology and especially in lexicography. It has many rare first editions of works of German literature from the sixteenth, seventeenth and eighteenth centuries and has sets of a number of rare periodicals. It is also rich in works upon the history of German civilization.

The Gröber Library in Romance Languages.—The University also possesses the library of Professor Gröber of the University of Strassburg. This library contains about 6,500 titles, and, added to what is already in the University library, furnishes somewhat over 10,000 volumes for this field.

The Vahlen Library, the property of the late Johannes Vahlen, Professor of Classical Philology at the University of Berlin, contains about 10,000 volumes and is in itself an excellent working library in classical philological literature. Being especially well supplied with texts of Greek and Latin authors, it supplements the Dittenberger collection. The addition of this interesting collection to the already good classical library of the University gives this institution one of the best libraries in this field of research in the country.

The Aron Library, collected by the late teacher and student of pedagogy, R. Aron, contains about 20,000 volumes. It is a scholarly collection of educational documents, among them many original and early editions, and furnishes firsthand material for the study of educational movements in Europe, especially in Germany, from the time of Luther and Comenius to the present. The collection of German "Fibeln" or school readers, is unique, and the material for the history of juvenile songs and literature, the set of 17th and 18th century atlases, the collection of rare hymn books and juvenilia make the collection very useful to students of education.

FEES AND EXPENSES

Except as noted below, graduate students pay fees as follows:

Matriculation fee	$10.00
Incidental fee, each semester	12.00
Diploma fee	5.00

All graduate students who have not matriculated as undergraduates at the University of Illinois pay the matriculation fee on entrance.

All graduate students pay the diploma fee on being recommended for their degrees.

No tuition or incidental fee is charged for graduate courses to scholars, fellows, or members of the corps of instruction or the staffs of the scientific bureaus or experiment stations, who are appointed by the Board of Trustees, nor for undergraduate courses on their study lists if approved by the heads of the departments and by the Dean of the School as necessary or desirable for the proper completion of the work for the degree. Otherwise, graduate students who take undergraduate courses must pay the proper undergraduate fee.

Each student working in laboratories, or in the drafting or engineering classes, is required to make a deposit of from 50 cents to $10.00, to pay for chemicals and apparatus used, and for any breakage or damages. But no charges or deposits for laboratory materials are required from scholars, fellows, or members of the corps of instruction or scientific staffs mentioned above.

Table board may be obtained at prices ranging from $4.00 per week. Room rent, with two in a room, ranges from $2.50 per week.

THE GRADUATE CLUB

The Graduate Club is an unofficial organization of the graduate students and graduate faculty. Its purpose is to furnish an opportunity for those working in different departments to become acquainted with one another and thus counteract the tendency toward narrowness which intense specialization may sometimes induce.

DEPARTMENTS OF INSTRUCTION

Courses open to graduate students are of two classes. The first class is wholly of graduate grade and the courses are numbered 100 upwards. The second class includes the courses classified as for graduates and advanced undergraduates. These carry numbers below 100. The courses numbered 100 and upwards are all accepted for major credit. Those of the other group are in many cases accepted only for minor credit. This is especially true of courses which are in any case open to juniors.

All courses have certain prerequisites for admission. Inasmuch as this prerequisite preparation may be gained at different institutions from courses differing from those offering a similar preparation at the University of Illinois, and a statement of prerequisites as given here would not be understood elsewhere, their description is omitted altogether. However, a student who wishes to enter a particular course must satisfy the department concerned that he has had in some form the prerequisites for admission to the course.

No course, the prerequisites of which are such as to admit students below junior grade (65 semester hours of credit) will be accepted for credit towards a master's or doctor's degree, except by vote of the faculty of the Graduate School in special subjects and for special reasons.

The amount of credit received for courses mentioned above for the master's degree is in accordance with the regulations of the Graduate School circular, pages 13 and 14.

No course may be listed for graduate credit among the courses for graduates and advanced undergraduates if it is conducted by a member of the staff who is himself registered as a graduate student in the same line of work.

Students are admitted to graduate standing in agriculture who have had a thorough training in the sciences underlying agriculture, who are otherwise eligible to the Graduate School, even though their undergraduate course of study lacked, to some extent, the amount and kind of technical work in agriculture included in our course of study.

ACCOUNTANCY

Courses for Graduates and Advanced Undergraduates

3a-3b. Accounting Problems and Auditing.—Must be taken throughout the year in order to secure credit. *Three times a week; both semesters.*

[This course may be taken for second minor credit only. It may be chosen only by students who have had at least two years' previous training in accountancy and whose major subject is economics (including commerce and business organization) railway administration, engineering or agriculture.]

AGRONOMY

Students taking their major work in agronomy must have had the major courses in agronomy offered to undergraduates in the College of Agriculture of the University of Illinois, or their equivalent. Graduate students may specialize either in soils or in crops. Courses 7, 9, 11 and 12, or the equivalent, will be required of graduates who specialize in soils and courses 7, 9, 12, and 22 or the equivalent will be required of those specializing in crops. While everyone seeking a doctor's degree with agronomy as a major will be required to have a general knowledge of the whole field of agronomy, each student is expected to prepare a thesis in some one of the divisions, soil fertility, soil physics, soil biology, plant breeding or crop production.

Students who are taking their major work in other departments and choose agronomy as a minor, must have had previously the work in chemistry, botany and other fundamental sciences prescribed for the undergraduate courses in agronomy in the College of Agriculture, or the equivalent.

Courses for Graduates

101. Soil Investigations.—System of soil investigations; sources of error and methods of control; interpretation of results. *Twice a week; both semesters. One unit.* Asssociate Professor Stewart..

104. Seminar in Agronomy.—*Once a week; both semesters. Half unit.* Dr. Whiting and others.

112. Plant Breeding.—This course includes a detailed study of the experiments at this station, and of methods and results reported from other states and from foreign countries. *Twice a week; both semesters. One to two units.* Professor Smith.

114. Crop Production.—A study of crop ecology and methods and results of crop production investigations. *Once a week; both semesters. One-half unit.* Associate Professor Burlison.

118. Investigations.—A special problem is chosen by each student. *Consultation one to five times a week for different students; both semesters. One to four units.* Professors Hopkins, Smith, Mosier, Associate Professors Stewart and Burlison, Dr. Whiting, Dr. Gernert.

Courses for Graduates and Advanced Undergraduates

7. Advanced Farm Crops.—A study of climatic and soil factors in relation to crop production; rotation; distribution of labor; cost of production; pure seed production; supply and consumption of products and by-products of farm crops; storage and marketing. *Three times a week; second semester.* Associate Professor Burlison.

11. Soil Biology.—Quantitative studies with respect to fertility of the biochemical activities of soil microörganisms. *Five times a week; second semester.* Dr. Whiting.

12. Soil Fertility, Fertilizers, Rotations.—The influence of fertility; effect of different crops upon the soil and upon succeeding crops, etc. *Five times a week; second semester.* Professor Hopkins.

12a. Soil Fertility, Fertilizers, Rotations.—(The same as Agronomy 12, for advanced students.) Lectures, quiz. *Twice a week; second semester.* Professor Hopkins.

22. Plant Breeding.—The improvement by breeding of field crops, including the grains, grasses, and legumes; the principles and methods of selection with critical studies of results obtained by various investigators. *Twice a week; second semester.* Professor Smith.

ANIMAL HUSBANDRY

Students entering graduate work in animal husbandry must have a thorough training in the fundamental principles of the subject either in connection with or in addition to an agricultural course of study substantially equivalent to that offered in this University.

Courses for Graduates

103. Live Stock Experimentation.—Objects, methods, and the sources of error in experimental work dealing with the feeding, breeding, and management of farm animals. *Once a week; both semesters. One-half unit.* Professor Davenport.

110. Animal Nutrition.—The biochemistry, the digestion, the metabolism, and the nutritive value of the proteins. *Twice a week; both semesters. One unit.* [Not given in 1916-1917.] Professor Grindley, Dr. Mitchell.

111. Animal Nutrition.—The biochemistry, the digestion, the metabolism, and the nutritive value of the fats and lipoids, the carbohydrates, and the inorganic substances. Lectures; seminar. *Twice a week; both semesters. One unit.* Professor Grindley, Dr. Mitchell.

112. Research.—Investigations along the following lines:

(a) Economic factors involved in meat production. Professor Mumford, Professor Coffey, Assistant Professor Rusk.

(b) Systems of live stock farming. Assistant Professor Handschin.

(c) The valuation of pedigrees. Professor Mumford.

(d) Animal Nutrition. The chemistry of feeding stuffs; metabolism experiments and biochemical studies connected with the nutrition of farm animals. Professor Grindley, Dr. Emmett, Dr. Mitchell.

(e) Genetics. Problems in heredity and variation. Assistant Professor Detlefsen.

(f) Wool. A study of the factors affecting the quality, quantity, strength, and condition of wool. Professor Coffey.

(a), (b), (c), and (f), one to three times, (d) and (e), five times a week; both semesters. One to two units. These courses may be taken during the summer by special permission.

117. GENETICS.—A study and criticism of the more important genetic experiments, the biological and mathematical methods employed, and the validity of the conclusions. *Three to five times a week; both semesters. One to two units.* Assistant Professor DETLEFSEN.

Courses for Graduates and Advanced Undergraduates

7. PRINCIPLES OF ANIMAL NUTRITION.—*Five times a week; first semester.* Professor GRINDLEY.

22. ADVANCED STOCK JUDGING.—A study of animal conformation with reference to market and show yard form; quality and condition. *Five times a week; first semester.* Various Members of the Department.

24. MEAT.—A study of the influence of type, condition, age, sex and feeds upon the yield and market grade of meat products. *Once a week; second semester.* Professor COFFEY.

26. SWINE.—The factors of animal nutrition that have to do with the large and economical production of pork and the determination of type in swine. *Once a week; second semester.* Mr. CARMICHAEL.

27. SHEEP HUSBANDRY.—Dealing with the factors determining the importance of the industry in leading sheep growing countries and particularly in different parts of the United States. *Once a week; second semester.* Professor COFFEY.

28. ADVANCED HISTORY OF BREEDS OF LIVE STOCK.—A study of the methods of prominent breeders, and the performances of great individual beef animals, horses, sheep and swine. *Once a week; first semester.* Professor MUMFORD and Other Members of the Department.

29. SYSTEMS OF LIVE STOCK FARMING.—A study of the principles of farm management as applied to live stock farming. *Twice a week; second semester.* Assistant Professor HANDSCHIN.

30. GENETICS.—The fundamental principles of heredity and variation. *Daily; second semester.* Assistant Professor DETLEFSEN.

31. ADVANCED COURSE IN ANIMAL NUTRITION.—A study of digestion; the histology and composition of the different body tissues; the metabolism of the different food nutrients, and the factors regulating metabolism; the effect of the food nutrients on metabolism; the fasting catabolism; food requirements and feeding standards; growth; the nutritive value of the different proteins and amino acids; etc. Lectures; recitations; laboratory. *Five times a week; second semester.* Dr. MITCHELL.

32. MARKETING LIVE STOCK.—A study of marketing and methods of marketing live stock and their products. *Twice a week; second semester.* Professor MUMFORD, Mr. WILCOX.

ARCHITECTURE AND ARCHITECTURAL ENGINEERING

The prequisite for graduate work in architecture and architectural engineering is the equivalent of the undergraduate courses required for the degree of Bachelor of Science in architecture and architectural engineering in the branches of the subjects in which registration is desired.

Courses for Graduates

101. ARCHITECTURAL CONSTRUCTION.—Design of special structures. *Twice a week; both semesters. One-half to one unit.*
Professor RICKER and Professor PROVINE.

102. SANITATION OF BUILDING.—The planning of the sanitation for buildings, modern methods of design and installation. *Twice a week; first semester. One-quarter to one-half unit.* Professor RICKER.

103. ADVANCED ARCHITECTURAL GRAPHICS.—Advanced course in the investigation and solution of problems by graphical methods. *Twice a week; both semesters. One to two units.* Professor PROVINE.

104. ARCHITECTURAL DESIGN.—Advanced work in Architectural Design. *Twice a week; both semesters. One to four units.* Assistant Professor ASH.

105. ARCHITECTURAL PRACTICE.—Contracts, specifications and office methods. *Twice a week; first semester. One-quarter to one-half unit.*
Professor PROVINE.

106. ARCHITECTURAL HISTORY.—Special research work. *Twice a week; both semesters. One-half to two units.* Professor RICKER.

ASTRONOMY

The prerequisites for graduate study in astronomy are mathematics through the calculus, a year's course in observational astronomy, and a course in college physics.

Courses for Graduates

101. SEMINAR. *Three times a week; both semesters. One unit.*
Professor STEBBINS.

102. STELLAR ASTRONOMY.—Orbits of binary stars; variable stars; theoretical photometry. *Three times a week; both semesters. One unit.*
Professor STEBBINS.

Courses for Graduates and Advanced Undergraduates

7-8. THEORETICAL ASTRONOMY.—Celestial mechanics; theory of orbits; perturbations; canonical transformations. *Three times a week; both semesters. One unit.* Dr. REED.

9-10. CELESTIAL MECHANICS.—*Three times a week; both semesters. One unit.* Dr. REED.

14. OBSERVATIONAL ASTRONOMY.—The working methods of an astronomical observatory. *Three times a week; second semester. One unit.*
Professor STEBBINS.

15. GEODETIC ASTRONOMY.—The sextant, transit, and zenith telescope; methods similar to those of the United States Coast Survey. *Three times a week; first semester. One unit.* Professor STEBBINS.

BACTERIOLOGY

The work outlined under courses for graduates is open only to graduate students taking bacteriology as a major, who have had 10 semester hours of bacteriology and 15 semester hours of Chemistry, part of which should be organic Chemistry.

Courses for Graduates

103. Physiology of Bacteria.—A study of the facts and theories of fermentation and growth and death of bacteria. *Twice a week; first semester. One unit.* Dr. Sperry.

105. Classification of Bacteria.—Variability of species; characters; mutations; standard and biometrical classifications. *Twice a week; second semester. One unit.* Dr. Sperry.

107. Research in Bacteriology.—The physiology of bacteria and food bacteriology. *Once a week; both semesters. One or two units.* Dr. Sperry.

Courses for Graduates and Advanced Undergraduates

20. General Bacteriology.—This course is intended especially for graduate students who do not take bacteriology as a major. To be admitted students must have had two years of college chemistry. Seniors who have had this amount of chemistry may also be admitted. *Daily; first semester.* Dr. Sperry.

26. Pathological Bacteriology.—Disease-producing organisms, their effects upon the animal and the reaction of the host. *Three times a week; second semester.* Dr. Sperry.

27. Epidemiology.—The ways in which contagious diseases are spread. *Twice a week; first semester.* Dr. Sperry.

[See also agronomy 11, 118; botany 22a-22b, 106; chemistry 10a, 110, 111; dairy husbandry 11, 12a-12b, 104, 105, 106.]

BOTANY

Candidates for advanced degrees in botany must offer for admission at least 20 hours in University botany, exclusive of general botany, and inclusive of morphology of thallophytes, plant physiology, taxonomy of cormophytes, and advanced work in either plant pathology, plant anatomy or physiology, or taxonomy of cormophytes, or plant ecology.

Graduate students who desire to elect botany for minor credit must offer the equivalent of 10 hours in University botany, exclusive of general botany, as a prerequisite to the courses listed for graduates and advanced undergraduates.

Courses for Graduates

101. Cytology.—The influence of external agents on the cell. Reports and discussions of current literature and research results. *Once a week; both semesters. One-half to two units.* Professor Hottes.

102. Physiology.—The effects of external stimuli on growth and movement. *Once a week; both semesters. One-half to two units.* Professor Hottes.

104. Mycology.—Field and laboratory investigations upon selected groups of fungi. *Once a week; both semesters. One-half to two units.* Professor Stevens.

106. Plant Pathology.—Diseases of plants, and disease agents. *Once a week; both semesters. One-half to two units.* Professor Stevens.

108. Taxonomy.—Monographic studies of critical groups. *Once a week; both semesters. One-half to two units.* Professor Trelease.

109. Ecology.—The interrelation of plants and their environment. *Once a week; both semesters. One-half to two units.* Dr. McDougall.

Courses for Graduates and Advanced Undergraduates

9a-9b. Plant Anatomy or Physiology.—Problems to meet the needs of individual students. *Twice a week; both semesters.* Professor Hottes.

10a-10b. Current Botanical Literature.—A weekly review covering the field of botany; supplementary to the various seminar conferences. *Once a week; both semesters.* Professor Trelease.

14a-14b. Heredity, Variation, Evolution.—A comparative study of the cells and of the members of plants, of their adaptations and changes, of the mechanism of heredity, and of the process of evolution. *Twice a week; both semesters.* Professor Hottes.

16a-16b. Taxonomy of Thallophytes.—Advanced practice on selected groups: (1) Algae and Bryophytes; (2) Fungi. *Once a week; both semesters.* Professor Stevens, Dr. Hague, Dr. McDougall.

17a-17b. Taxonomy of Cormophytes.—Advanced practice on selected taxonomic, ecological or economic groups. Specialized studies, as of genera or families of Illinois plants. *Once a week; both semesters.* Professor Trelease.

22a. Morbid Histology.—Studies of the histology of plant tissues and of their parasites in condition of disease. *Once a week; first semester.* Professor Stevens.

22b. Studies of Special Groups of Fungi or Diseases of Special Crops or Groups of Crops. *Once a week; second semester.* Professor Stevens.

25a-25b. Plant Ecology.—Advanced studies in the ecology of plants or of plant communities. *Once a week; both semesters.* Dr. McDougall.

BUSINESS ORGANIZATION AND OPERATION

Courses for Graduates

101. Regulation and Control of Mercantile Distribution.—Federal, state, and local regulation of mercantile business; unfair competition; trade agreements; trade marks; inspection of mercantile establishments; pure food acts; control over weights and measures, packing, storage, and shipment. *Twice a week; first semester. One unit.* Assistant Professor Young.

102. Scientific Management.—The history of the scientific management movement; critical study of the proposed systems. *Twice a week; both semesters. One unit.* Assistant Professor Young.

[Not given in 1916-17.]

Courses for Graduates and Advanced Undergraduates

4. Industrial Organization and Management.—Problems of organization and of administrative policy; supervision and management of industries and industrial units, etc. *Twice a week; second semester.* Assistant Professor Young.

CERAMIC ENGINEERING

The prerequisite for graduate work in ceramic engineering is the equivalent of the undergraduate courses required for the degree of Bachelor of Science in ceramic engineering in the branches of the subject in which registration is desired.

Courses for Graduates

101. The Formation of Silicates.—Theoretical principles involving the conceptions of physical chemistry; thermal studies. *Three times a week; first semester. One to two units.*

102. Technology of the Clay Industries.—Mineralogical constitution of clays; plasticity and the colloidal state; pyro-chemical and physical changes; composition and constitution of bodies; glazes and enamels. *Three times a week; both semesters. One to two units.*

103. Technology of Cements.—Composition and constitution of cements; hydration and dehydration of cementing compounds; action of catalyzers. *Three times a week; second semester. One to two units.*

104. Technology of Glass.—Fusion studies of glassy silicates; limiting compositions; physical and chemical properties of glasses. *Twice a week; second semester. One to two units.*

Courses for Graduates and Advanced Undergraduates

5. Ceramic Bodies.—Composition and properties of ceramic body mixtures; effects of various ingredients; development of special bodies. Lectures; laboratory. *Daily; second semester.*

6. Glazes.—Production of glazes and enamels; limits of composition; classification; properties and defects common to each class; effect of variation in composition; modes of application. Lectures; laboratory. *Daily; first semester.*

8. Glass.—Raw materials, preparation, compounding, melting, and shaping; chemical principles involved in the manufacture and decoration of the various types of vitreous silicates. *Twice a week; second semester.*

10. Cements.—Cements, limes, plasters; composition; reactions; methods of manufacture and testing. *Three times a week; first semester.*

CHEMISTRY

Admission to Graduate Work: Graduate students whose major subject is in some other department than chemistry, must have had the equivalent of 15 semester hours in chemistry. The ground covered must include satisfactory work in general chemistry and in qualitative and quantitative analysis. Such students are advised to make selections from the following courses: Chemistry 31, 33, (or 102, 102a), 14a, 14b, 9a, 9b, 15 and 25. Students will not be admitted to courses of a special nature, for graduate credit, unless they have previously taken the appropriate prerequisite courses from the above list.

Graduate students who wish to elect chemistry as their major subject of study must have had the equivalent of 25 semester hours in chemistry, and this amount must include satisfactory courses in general chemistry, qualitative and quantitative analysis, and either physical chemistry, or organic chemistry. They must also have had at least one year of college physics and a training in mathematics which includes analytical geometry and for those who do not present an acceptable course in physical chemistry, the calculus. The ability to use the calculus is a prerequisite to all courses in physical chemistry.

Statement concerning courses required for an advanced degree:—Before receiving any degree in chemistry the student must have completed work equivalent to courses 31, 33 (or 102 and 102a), 14a, 14b, 9a, 9b. He is advised to take at least brief courses in the history of chemistry, gas analysis, iron and steel analysis, water analysis, assaying and chemical technology.

For students taking chemistry as a major, courses 5a, 13a, will not be accepted for graduate credit; and 9a, 9b, 14, 31 and 33 will be accepted only from such students if on entering the Graduate School they have had the equivalent of 25 semester hours in chemistry.

Courses for Graduates

102. Advanced Physical Chemistry.—This course, together with 102a, is intended to cover a period of two years. The subject is treated from the standpoint of *Molecular Kinetics and Thermodynamics. Twice a week; both semesters. Three-quarters unit.* Professor Washburn.

102a. Advanced Physical Chemistry.—Chemical equilibrium; the Phase Rule; certain portions of thermo-chemistry, photochemistry; the thermodynamics of electrochemistry. (A continuation of 102, with which it alternates.) *Twice a week; both semesters. Three-quarters unit.* Professor Washburn.

[Not given in 1916-17.]

102b. Advanced Electrochemistry.—The modern theories of solution and the principles of thermodynamics in their application to the problems of electrochemistry. *Twice a week; second semester. Three-quarters unit.*

[Not given in 1916-17.] Dr. MacInnes.

102c. Advanced Physical and Electrochemistry Laboratory.—This course must be preceded or accompanied by Chemistry 102, 102a, or 102b. *Twice a week; first semester. One-half to one unit.*

Professor Washburn, Dr. MacInnes.

102d. Electrochemistry.—This course includes a discussion of theoretical and applied electrochemistry with the emphasis chiefly on the technical side of the subject. *Once a week; first semester. Half unit.* (For students of electrical engineering.) Dr. MacInnes.

102e. Special Topics in Physical Chemistry.—The course will be conducted on the seminar plan and the topics considered will vary from year to year. Subject for 1916-17: Chemistry of the Radioelements, and Radioactivity. *Once a week; first semester. Half unit.* Professor Washburn.

102f. The Chemistry and Physics of Colloids.—The classification of disperse systems, adsorption, ultramicroscopy. Electrical, chemical and catalytic properties of colloids. Seminar and laboratory. *Twice a week; first semester. Three-quarters unit.* Dr. MacInnes.

103. Advanced Inorganic Chemistry.—Descriptive inorganic chemistry; the rarer elements; the periodic system. *Two to five times a week; both semesters. One-half to one and one-fourth units.*

103a. Advanced Analytical Chemistry.—*One to five times a week; second semester. One-half to one and one-quarter units.*
Assistant Professor Smith.

103b. Special Topics in Inorganic Chemistry.—Lectures and Seminar. Subject for 1916-17: The Chemistry of the Higher Order Compounds. *Twice a week; first semester. Three-quarters unit.* Assistant Professor Smith.

103c. Special Topics in Inorganic Chemistry.—Seminar. The Determination of Atomic Weights. *Twice a week; second semester. Three-quarters unit.*

104. Advanced Organic Chemistry.—Seminar. A systematic study of the open chain compounds of the carbon, hydrogen and oxygen atoms from the standpoint of the atomic linking theory, followed by the study of tautomerism, stereochemistry and the carbohydrates. *Three times a week; both semesters. Three-quarters unit.* Assistant Professor Derick.

104a. Advanced Organic Chemistry.—(Continuation of 104, with which it alternates). A systematic study of the closed chain compounds of the carbon, hydrogen and oxygen atoms and of the organic compounds of nitrogen, followed by the study of the ureids, alkaloids, and color and constitution. *Three times a week; both semesters. Three-quarters unit.*

[Not given in 1916-17.] **Assistant Professor Derick.**

104b. Advanced Quantitative Organic Analysis.—The quantitative chemistry of the proteins, alkaloids, glucosides, volatile oils, and other constituents of animal and vegetable tissues. *Twice a week; both semesters. Three-quarters unit.* Dr. Beal.

104c. Special Topics in Organic Chemistry.—Seminar in which recent books dealing with special phases of organic chemistry are read and discussed. Topic for 1916-1917: *Chemical Constitution and Physiological Action.* L. Spiegel. Publishers, Van Nostrand. *Once a week; second semester. One-fourth unit.* Assistant Professor Derick.

105. Advanced Physiological Chemistry.—The structure and distribution of the proteins; intermediary metabolism and the glands of internal secretion. Lectures; demonstrations; assigned reading; discussions. *Twice a week; second semester. Three-fourths unit.* Dr. Lewis.

105a. Advanced Physiological Chemistry.—Difficult biochemical preparations; the use of the newer analytical methods. Laboratory. *One to five times a week; first or second semester. Three-fourths unit.* Dr. Lewis.

105b-105c. Advanced Physiological Chemistry.—Seminar. The recent development of physiological chemistry. *Twice a week; both semesters. Three-quarters unit.* Dr. Lewis.

105d. Chemistry of Plant Nutrition.—Dealing with the occurrence of organic compounds in plants, and their relation to plant nutrition. *Two to four times a week; second semester. Three-quarters to one and one-quarter units.* Dr. Beal.

106. Animal Chemistry (Animal Nutrition).—*Five times a week; both semesters. One to one and one-half units.* Professor Grindley.

107. Calorimetry.—Standards and methods. *One to three times a week; both semesters. One-half to one unit.* Professor Parr.

108. Advanced Metallography.—The constitution and microstructure of metals and alloys; the relations between their properties, chemical and mechanical treatment, and structure. *Twice a week; first semester. Three-quarters unit.* Assistant Professor McFarland.

109. Advanced Industrial Chemistry.—*Seminar.* A detailed study of some of the more important chemical industries, and the development and chemical control of processes. *Twice a week; both semesters. Three-quarters unit.* Assistant Professor McFarland.

110. Water Supplies.—A study of the sources of contamination of water supplies and the purification of water for potable or technical use. *One to five times a week; both semesters. One-half to one unit.* Professor Bartow.

111. Research.—*Once a week; both semesters.*

Physical and Electrochemistry. Professor Washburn, Dr. MacInnes.

Inorganic Chemistry. Assistant Professors Smith, Weber.

Analytical Chemistry. Assistant Professor Smith.

Food Chemistry. Dr. Beal.

Organic Chemistry. Professor Noyes, Assistant Professor Derick.

Water Chemistry. Professor Bartow.

Physiological Chemistry. Dr. Lewis.

Animal Chemistry Nutrition. Professor Grindley.

Industrial Chemistry. Professor Parr, Assistant Professor McFarland.

Courses for Graduates and Advanced Undergraduates

*6. Chemical Technology.—Technological chemistry as illustrated in those industries having a chemical basis for their principal operations and processes. *Three times a week; second semester.*

Assistant Professor McFarland.

*7. Metallurgy.—The time of the course is divided about equally between general metallurgy, metallurgy of iron and steel, and metallurgy of the non-ferrous metals. *Three times a week; first semester.*

Assistant Professor McFarland.

7a. Metallurgy of the Non-Ferrous Metals.—Particularly copper, lead, zinc, gold and silver. *Three times a week; second semester.*

Assistant Professor McFarland.

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*Certain required inspection trips will be arranged in connection with courses 6 and 7. Students registering in these courses should take into consideration the expense involved, which will approximate $15.00 for each course.

8. Iron and Steel Analysis.—Three times a week; second semester. Assistant Professor Smith.

9. Organic Chemistry.—The more typical and simple organic compounds; important derivatives of carbon. *Three times a week; second semester.* Assistant Professor Derick.

9a. Organic Synthesis and Ultimate Analysis.—*Twice a week; first or second semester.* Assistant Professor Derick.

9b. Organic Synthesis and Qualitative Organic Analysis.—Continuation of 9a, to accompany Chemistry 14b. *Twice a week; first or second semester.* Assistant Professor Derick.

9c. Organic Synthesis.—Typical organic compounds. Laboratory. *Twice a week; second semester.* Assistant Professor Derick.

10a. Study of Water Supplies.—History, sources, contamination, and standards of purity of potable waters and waters for industrial purposes, together with practice in analytical methods. *Three times a week; second semester.* Professor Bartow.

14a-14b. Organic Chemistry.—Lectures; recitations. Noyes's *Organic Chemistry.* This course should be accompanied by Chemistry 9a and 9b. *Four times a week, first semester; twice a week, second semester.* Professor Noyes.

15. Physiological Chemistry.—*Five times a week; first semester.* Dr. Lewis.

15a. Problems of Metabolism (Intended Especially for Medical Students). *Twice a week; second semester.* Dr. Lewis.

21. Qualitative Organic Analysis.—Systematic methods for identification of pure organic compounds and mixtures. *Twice a week; first or second semester.* Assistant Professor Derick.

22. Animal Chemistry (Animal Nutrition).—The chemical composition of animal products and feeding stuffs. *Five times a week; first or second semester.* Professor Grindley.

25. Food Analysis.—Quantitative organic analysis, with special reference to the examination of food products: alcohols, carbohydrates, fats and oils, cereals, nitrogenous bodies, preservatives, and colors. *Five times a week; both semesters.* Dr. Beal.

27. Qualitative Analysis of the Rare Elements.—*Three times a week; second semester.*

28. Advanced Qualitative Analysis.—Designed especially for those intending to teach qualitative chemistry. *One to three times a week; first semester.* Assistant Professor Weber.

31. Elementary Physical Chemistry.—*Four times a week; second semester.* Professor Washburn.

33. Elementary Physical Chemistry.—A laboratory course to accompany course 31. *Twice a week; second semester.* Dr. MacInnes.

35. Electrochemistry.—Lectures and laboratory work. See also Chemistry 102b. *Three times a week; first semester.* Dr. MacInnes.

37. Experimental Problems in Physical and Electrochemistry.—Technical and scientific problems are worked out in the laboratory by students indi-

vidually. Each student must spend at least twelve hours a week on his work. *First semester.* Professor WASHBURN, Dr. MACINNES.

61. INDUSTRIAL CHEMICAL LABORATORY.—The preparation and purification of chemical products from raw materials on a scale sufficient to afford data for determining the economy of the processes employed. This course should be accompanied by either Chemistry 6 or 109. *Three times a week; second semester.* Assistant Professor MCFARLAND, Dr. BRODERSON.

66. TECHNOLOGY OF GASES.—*Once a week; second semester.* Professor PARR.

66a. GAS MANUFACTURE.—Carbonization processes, ovens and by-products. *Once a week; second semester. One-half unit.* Professor PARR.

69. METALLURGICAL LABORATORY AND ASSAYING.—The fire assay of gold, silver, lead and copper ores, mattes, and bullion, together with special experiments illustrating the underlying metallurgical principles. *Twice a week; first semester.* Assistant Professor MCFARLAND.

70. ADVANCED ASSAYING AND ORE TESTING.—(A continuation of Chemistry 69.) *Twice a week; second semester.* Assistant Professor MCFARLAND.

71. ADVANCED METHODS OF METALLURGICAL ANALYSIS.—Study and comparison of selected methods for analyses of ores, alloys and metallurgical products. *Twice a week; first semester.* Assistant Professor MCFARLAND.

72. PAINTS, OILS, TURPENTINES, VARNISHES AND PROTECTIVE COVERINGS FOR WOOD AND METALS.—Lectures and laboratory. *Twice a week; first semester.* Professor PARR.

76. CALORIMETRY OF FUELS.—Methods for determining the heat values of solid, liquid, and gaseous fuels. *Twice a week; second semester.* Professor PARR.

77. COMPOSITION AND CLASSIFICATION OF COAL.—Classification, changes in composition, weathering, spontaneous combustion, formation of mine gases. Lectures; assigned reading. *Once a week; second semester.* Professor PARR.

78. METALLOGRAPHY.—Constitution and microstructure of metals and alloys and on the relations between their properties, chemical and mechanical treatment and structure. *Twice a week; second semester.* Assistant Professor MCFARLAND.

93. JOURNAL MEETING.—For seniors and graduates. *Once a week; both semesters.* Assistant Professor MCFARLAND.

95. HISTORY OF CHEMISTRY.—*Twice a week; first semester.* Assistant Professor SMITH.

Besides the formal courses outlined above, regular scientific meetings are held by the colloquiums of industrial, physical, inorganic, physiological and organic chemistry; by the Chemical Club; by Phi Lambda Upsilon and by the University of Illinois Section of the American Chemical Society.

CIVIL ENGINEERING

The prerequisite for graduate work in civil engineering is the equivalent of the undergraduate courses required for the degree of Bachelor of Science

in civil engineering in the branches of the subject in which registration is desired.

Courses for Graduates

101. Irrigation and Drainage.—Principles of engineering as applied to the survey, examination, construction, maintenance and operation of works for irrigation and drainage of agricultural lands. Also a discussion of the rights to the use of water. *Twice a week; both semesters. Half unit.*

Professor Newell.

106. Reinforced Concrete Design.—Application of theory of elasticity to the design of reinforced concrete structures. Specifications for reinforced-concrete design. Concrete forms. Typical reinforced-concrete structures. Methods and costs of reinforced concrete construction. *Twice a week; both semesters. One and one-half units.*

107. Bridge Engineering.—Theory of deflections; the general problem of the statically indeterminate frame; applications to swing bridges and arches; special graphical methods; theory of suspension bridges; secondary stresses; impact. *Twice a week; both semesters. One unit or more.* Professor Ellis.

124. Steel Building Construction.—The design of steel framing of fireproof office buildings, hotels, and industrial buildings; theory of wind bracing; long columns; eccentrically loaded columns; eccentric connections; analysis of special details; erection methods and cost. *Three times a week; both semesters. One unit or more.*

Assistant Professor Wilson.

Courses for Graduates and Advanced Undergraduates

60. Structural Stresses.—The determination of stresses in roofs, bridges, and steel-skeleton buildings, by algebraic and graphic processes. *Three times a week; second semester.* Assistant Professor Wilson.

83. Bridge Design.—Determination of stresses and sections of a plate girder and a truss span; stress sheet, general design drawings, and estimate of weights. *Three times a week; first semester.* Assistant Professor Wilson.

87. Advanced Bridge Analysis.—Continuous, draw, cantilever, suspension, and metal-arch bridges. *Twice a week; first semester.* Professor Ellis.

88. Steel Building Design.—Stresses and sections of the steel frame of mill and office buildings; footings and grillages; design drawings and estimate of weights. *Three times a week; second semester.*

Assistant Professor Wilson.

89. Hydro Economics.—The occurrence of water in nature; conservation, regulation and use of water for power and in various industries; irrigation, drainage, transportation, domestic supply; the legal title to the use of water. *Twice a week; both semesters.* Professor Newell.

THE CLASSICS

The Degree of Master of Arts in the Classics.– The major may be either Latin or Greek.

Before the period of the regular course examinations of the second semester, each candidate must also pass two examinations which are to be regarded as tests of attainment rather than as a requirement of special or addional preparation. The first examination consists of written translation at sight, from the candidate's major language, of passages equivalent in difficulty to the work of first-year graduate courses. The second examination is oral and designed to determine the candidate's general ability and his advancement in the various fields of classical philology, especially those treated in course 110, Bibliography and Criticism.

The Degree of Doctor of Philosophy in the Classics.—The degree is given in classical philology. Major work may be taken in either Latin or Greek, but which ever language is taken as a major, the other must be taken as the first minor.

Greek

Preparation for first-year graduate work in Greek must include at least two years of preparatory Greek, two years of college Greek and two years of college Latin. A reading knowledge of French or German, preferably the latter, is highly desirable for candidates in this subject. The study of history and philosophy is especially recommended.

Courses for Graduates

104. Homer and the Homeric Question.—*Twice a week; both semesters. One unit.* Professor Oldfather.

105. Plato and Aristotle.—*Twice a week; both semesters. One unit.* [Not given in 1916-17.] Professor Oldfather.

108. Greek Drama.—*Twice a week; both semesters. One unit.* [Not given in 1916-17.] Professor Moss.

107. Greek Oratory.—Speeches of several orators are read rapidly, and a detailed study made of one or two authors. *Twice a week; both semesters. One unit.* Professor Moss.

Courses for Graduates and Advanced Undergraduates

(For minor credit only)

5. Herodotus: The Lyric Poets.—Selections. *Three times a week; second semester.* Professor Moss.

[Not given in 1916-17.]

6. Thucydides.—Books VI-VII. *Three times a week; first semester.* [Alternates with 8. Not given, 1916-17.] Professor Pease.

7. The Drama.—*Three times a week; second semester.* Professor Moss.

8. Plato—Selected Dialogues, including Phaedo, the Apology. *Three times a week; first semester.* Professor Oldfather.

21. See Latin 21.

Latin

Preparation for first year graduate work in Latin must include at least two years of preparatory Latin, and four years of college Latin, or three years of preparatory Latin and three years of college Latin. A reading knowledge of

French or German, preferably the latter, is highly desirable. Some acquaintance with Greek is indispensable, and the study of history and philosophy is especially recommended.

Courses for Graduates

102. ROMAN ORATORY.—The subject is studied in its development as a department of literature, with special reference to the Ciceronian period. *Twice a week; second semester. One unit.* Assistant Professor CANTER.

103. CICERO.—The De Natura Deorum and the De Divinatione. The Epicurean, Stoic, and Academic theories of religion and their relation to the popular worship. *Twice a week; first semester. One unit.* [Not given in 1916-17.] Professor PEASE.

104. LATIN PALAEOGRAPHY.—Lectures on the material and form of ancient books, the methods of copying, and the common errors in manuscripts. A study of the facsimiles of codices, and practice in text criticsm. *Twice a week; first semester. One unit.* [Not given in 1916-17.] Professor PEASE.

106. TERRENCE.—The comedies are read and two or three plays interpreted. Lectures on literary history and the syntax of early Latin. *Twice a week; second semester. One unit.* Professor OLDFATHER.

107. LATIN EPIGRAPHY.—The purpose of this course is to familiarize the student with the forms and language of inscriptions and to read selections from those in the Corpus Inscriptionum Latinarum. *Twice a week; second semester. One-half to one unit.* [Not given in 1916-17.] Professor PEASE.

108. TACITUS.—The Histories. Emphasis is placed on political and social conditions. *Twice a week; first semester. One unit.* Professor BARTON.

109. VIRGIL.—The life and works of Virgil, with study of his sources and of his influence upon later literature. *Twice a week; second semester. One unit.* [Not given in 1916-17.] Professor PEASE.

112. ROMAN HISTORIOGRAPHY.—*Twice a week; first semester. One unit.* Assistant Professor CANTER.

113. PLAUTUS.—Six comedies are read and two or three interpreted. *Twice a week; first semester. One unit.* Professor OLDFATHER.

114. CAESAR.—The historical works, especially the Bellum Gallicum. *Twice a week; second semester. One unit.* Professor OLDFATHER.

115. ROMAN ELEGY.—Elegy as a department of literature, and its relation to other lyric forms; translations from Catullus, Tibullus, and Propertius. *Twive a week; first seemster. One unit.* Assistant Professor CANTER.

Courses for Graduates and Advanced Undergraduates

7. SATIRE.—Selected Satires and Epistles of Horace and selected Satires of Juvenal. *Three times a week; first semester.* Professor BARTON.

8. TACITUS.—The annals. Books I-VI. *Three times a week; first semester.* [Not given in 1916-17.] Professor PEASE.

14. SENECA.—Selections from his letters and tragedies. *Three times a week; second semester.* Professor BARTON.

16. MARTIAL AND SUETONIUS.—Selections; lectures on literary history. *Three times a week; second semester.* [Not given in 1916-17.] Professor OLDFATHER.

2. Late Latin.—Rapid reading of selections from Latin writers from Minicius Felix to Cassiodorus. *Twice a week; second semester.* [Not given in 1916-17.] Professor Pease.

21. Special Topics in the History of Greece and Rome.—Introduction to the methods of research in Greek and Roman history. The topic for 1917 is: The problem of the decline of ancient civilization, especially in the second century after Christ. *Twice a week; second semester.* Professor Oldfather.

Prerequisite: Junior standing; 11 hours in history; the ability to read Latin, and either German or French; if the topic chosen be in Greek history, the ability to read ordinary Greek.

Classical Philology

110. Bibliography and Criticism.—This course is designed to make clear the aims and methods of classical Philology.

All graduate students who are taking Latin or Greek as a major for the master's degree must take this course unless they have already completed it or its equivalent. *Once a week; both semesters. One-quarter unit.*

Professors Oldfather, Canter, and others.

Attention is also called to Comparative Philology 2,—Comparative Philology in the Indo-European Languages. *Twice a week; second semester.*

Assistant Professor Bloomfield.

DAIRY HUSBANDRY

The prerequisite for major work in dairy bacteriology is ten semester hours in bacteriology, together with a proper training in chemistry and other subjects leading logically to the study of bacteriology. The requirement for minor standing is five semester hours in bacteriology with accompanying prerequisites.

In dairy production the prerequisite for graduate standing in major work for a master's degree is thirteen hours of undergraduate work in dairy husbandry and for minor work for the master's degree eight semester hours of undergraduate work in dairy husbandry.

Courses for Graduates

101. Economic Milk Production.—A study of differences in the efficiency of dairy cows, cause and effect of the same, and the relation they bear to successful dairy farming. *Twice a week; both semesters. One unit.*

Professor Fraser.

104. Scientific Readings.—Reading and discussion of some German or French bacteriological text. Recommended for first and second year students. *Once a week; both semesters. One-half unit.*

Professor Harding, Assistant Professor Prucha.

105. Bacteriological Literature.—Systematic readings. Each student is required to prepare and deliver an acceptable course of lectures. Recommended for second and third year men. *Once a week or once in two weeks; both semesters. One-half or one unit.* Professor Harding.

106. Research on Assigned Problems.—Open to graduate students whose development permits their attacking dairy bacteriological problems with only general supervision. *Both semesters. One-half to two units.*
Professor Harding, Assistant Professor Prucha.

107. Dairy Chemistry.—A survey of the literature of dairy chemistry. Special investigation of assigned problems. *Once a week. Both semesters. One unit.* Dr. Kohmann.

*Courses for Graduates and Advanced Undergraduates**

11. Dairy Bacteriology.—General survey of the bacteria of milk and its products from udder to the consumer, giving attention to their methods of introduction, their effect upon the milk and methods for their control. *Twice a week; first semester.* Professor Harding.

12a-12b. Laboratory work supplementing dairy husbandry 11. *Four times a week; both semesters.* Professor Harding, Mr. Allen.

21. Economic Milk Production.—*Five times a week; second semester.*
Professor Fraser.

ECONOMICS

Every student entering upon graduate work in economics must have had a course in the principles of the science and also in some special part of the field, such as public finance or money and banking. The work must represent at least eight semester hours.

Graduate students who are making economics their major are required during their first year to acquaint themselves with the works of the masters in the science, either by taking course 101 or by private reading for examination. In the second or third year they are expected to elect courses 105 and 120, and some fundamental course in political science and sociology (either course 11 or 102 in sociology, and political science 101 and 102) unless they have already had such courses.

The following courses may be taken by students in general economics for major or minor credit: all numbered above 100; 4, 5, 10, 12, 13, 19, 20, 21, 29, 51. The following may be taken for minor credit only: 8, 9, 14, 15, 17, 28, 31.

Two units will be accepted for a first minor for the master's degree; and four two or three hour graduate courses, or their equivalent in advanced undergraduate courses, for a first minor for the doctor's degree.

Courses in Transportation may be included in their programs by students of Economics as part of either their major or minor subjects. See Transportation.

Courses for Graduates

101. Economic Theory.—The classical economics. *Twice a week; both semesters. One unit.* Professor Kinley.

102. Theory of Money, Credit and Prices.—*Twice a week; both semesters. One unit.* Professor Kinley.

[Not given in 1916-17.]

*See also Bacteriology.

104. Foreign Commerce.—*Twice a week; both semesters. One unit.*
Assistant Professor Litman.

105. Public Finance.—*Twice a week; both semesters. One unit.*
[Not given in 1916-17.] Professor Bogart.

107. The Corporation in Economic Evolution.—*Twice a week; both semesters. One unit.* Professor Robinson.
[Not given in 1916-17.]

109. Theory of Industrial Consolidation.—The nature, causes and ef-effects of industrial consolidations, with special reference to prices, profits and wages. *Twice a week; both semesters. One unit. Time to be arranged.*
[Not given in 1916-17.] Professor Robinson.

110. Investments.—Nature, character and function of investments. Classes, including direct investments and securities of various types. Methods of judging investments. State control. *Twice a week; both semesters. One unit.*
Professor Robinson.

118. Seminar.—The Seminar meets bi-weekly for the discussion of the results of students' investigations, etc. Members of the Staff.

120. History of Economic Thought.—*Twice a week; both semesters. One unit.* Dr. J. G. Thompson.

122. Advanced Economic History of the United States.—*Twice a week; both semesters. One unit.* Professor Bogart.

Theory of Statistics. See mathematics 129.

Courses for Graduates and Advanced Undergraduates.

4. Financial History of the United States.—*Three times a week; first semester.* Mr. Douglas.

5. Public Finance.—Public *debts, revenue, taxation, etc. Three times a week; first semester.* Professor Bogart.

5. The Money Market.—*Twice a week; second semester.*
Assistant Professor Weston.

9. Practical Banking.—*Twice a week; first semester.*
Assistant Professor Weston.

10. Corporation Management and Finance.—*Thee times a week; second semester.* Professor Robinson.

11. Industrial Consolidation.—The development of industrial consolidations; plans for controlling trusts, etc. *Three times a week; first semester.*
[Not given in 1916-17.] Professor Robinson.

12. Labor Problems.—*three times a week; both semesters.*
Mr. Hoagland.

13. Economic Development of Europe Since the Industrial Revolution.—*Three times a week; second semester.* Professor Bogart.

14. Agricultural Cooperation.—A study of the organization, financing, and management of cooperative associations for the promotion of various branches of farming. *Twice a week; second semester.* Dr. Stewart.

15. Rural Credit.—*Twice a week; first semester.* Dr. Stewart.

17. Economic History of Agriculture.—General characteristics of agriculture, and its development as an industry in various countries at various times. State of the agricultural class. Relation of agriculture to other industries. Relation of the state agriculture. *Twice a week; second semester.*
Dr. J. G. Thompson.

19. United States Industry, 1820-1860.—*Twice a week; first semester.*
Dr. C. M. Thompson.

20. United States Industry Since 1860.—*Twice a week; second semester.*
Dr. C. M. Thompson.

21. Socialism and Economic Reform.—Twice a week; second semester.
Mr. Douglas.

28. Mechanism and Technique of Domestic Commerce.—*Three times a week; first semester.* Assisant Professor Litman.

29. International Trade and Trade Policies.—*Three times a week; second semester.* Assistant Professor Litman.

[Not given in 1916-17.]

31. Organization of Foreign Commerce.—A study of exporting and importing; means of communication and of transportation; the shipping business; duties of consuls. *Three times a week; second semester.*
Assistant Professor Litman.

EDUCATION

Students who elect education as a major subject must have completed at least a three-hour course in the principles of education, a course of at least the same length in the history of education, and a minimum of three hours each in psychology and philosophy. For graduate students who have had experience in teaching, these requirements may be modified.

Courses for Graduates

101. Seminar in Educational Theory.—The general topic for 1916-17 will be announced later. *Once a week, two hours; first semester. One unit.*
Professor Bagley.

106. Seminar in Secondary Education.—Organization, administration, and special methods of secondary education. *Once a week, two hours; second semester. One unit.*

112. Principles of Education.—A course for graduate students who are not majoring in education and who have not taken undergraduate courses in education. The course involves: (1) a brief survey of the American public-school system; (2) a statement of the leading principles and doctrines of educational science; and (3) a brief reference to the technique of teaching and the problems of class management. All graduate students who expect to teach are urged to take this course if they have not had previous training in Education or experience in teaching. *Twice a week; second semester. Half unit.*
Professor Bagley.

119. The Elementary Curriculum.—*Twice a week; second semester. One unit.*

125. Seminar in Educational Psychology.—*Once a week, two hours; first semester. One unit.* Professor Whipple.

Departmental Conference.—Every alternate Monday from 7 to 9 P. M. All graduate students majoring in education are expected to meet with the departmental staff at this time. The work carries no credit. *First and second semesters.*

Courses for Graduates and Advanced Undergraduates

4. Problems of Educational Administration.—The interpretation of present tendencies. *Three times a week; first semester.*

5. Comparative Education.—A comparative study of the educational organization, administration, and basic national ideals of the schools and school systems of the United States, Germany, England, and France, with particular reference to secondary education and to the training of teachers. *Three times a week; first semester.* Professor Johnson.

13-14. Educational Classics.—A detailed study of the principal educational writings of Plato, Aristotle, Quintilian, Montaigne, Vittorino, Da Feltre, Milton, Locke, Comenius, Rousseau, Pestalozzi, Froebel, and Herbert Spencer. *Three times a week; first and second semesters.*
Professor Whipple.

15. School Hygiene.—*Twice a week; second semester.*
Professor Whipple.

16. Method in Educational Research.—*Twice a week; first semester.*

20a. Theory of Supervision.—*Three times a week; second semester.*
Professor Bagley.

27. High School Curriculums.—*Three times a week; second semester.*
Professor Johnston.

41. Vocational Education.—*Three times a week; second semester.*
Professor Johnston.

42. Auxiliary Education.—The institutions and methods involved in the training of defectives and delinquents; the Binet-Simon tests and other methods of mental diagnosis; educational treatment of morons and of moral delinquents; an outline of the methods of teaching sensory defectives (the blind and the deaf); public institutions of auxiliary education and their administration. *Three times a week; second semester.* Professor Whipple.

43. Mental Tests.—Laboratory drill in the technique of mental tests, including tests of sensory capacities; attention; memory; learning; suggestibility; inventiveness; systems of tests for diagnosis of mental age, general intellectual status, mental retardation, etc. *Twice a week; second semester.*
Professor Whipple.

45. Research Problems in Educational Psychology.—*Either semester.*
Professor Whipple.

ELECTRICAL ENGINEERING

The prerequisite for graduate work in electrical engineering is the equivalent of the undergraduate courses required for the degree of Bachelor of Science in electrical engineering in the branches of the subject in which registration is desired.

Graduate students who wish to take a minor in electrical engineering must have had differential and integral calculus, and one year's work in college physics.

Courses for Graduates

101. ADVANCED COURSE IN ALTERNATING CURRENTS.—The Theory of Transient Phenomena; polyphase circuits; measuring apparatus. *Twice a week; both semesters. One and one-half units.* Professor PAINE.

103. ELECTRICAL DESIGN.—Plans for an electrical machine or apparatus of specified character; or for the arrangement of an electrical plant; or for the installation of such machinery or apparatus. *Twice a week; second semester. One unit.* Assistant Professor WALDO.

104. TELEGRAPHY AND TELEPHONY.—Telegraph apparatus and methods including quadruplex systems and high speed telegraphy. Manual and automatic telephone systems. *Once a week; first semester. One unit.* Professor BROOKS.

105. ELECTRICAL ENGINEERING RESEARCH.—Investigation of electrical phenomena, or tests of some electrical machine, or of a plant of such machines. *Twice a week; both semesters. One to three units.* Professor PAINE.

106. ILLUMINATION.—The investigation of problems in illumination. A study of the various light sources. *Once a week; both semesters. One unit.* Professor BROOKS.

Courses for Graduates and Advanced Undergraduates

(The courses are open only for minor credit to students not candidates for a degree in electrical engineering.)

14. ALTERNATING CURRENTS.—*Four times a week; first semester.* Professor PAINE, Mr. FISK, Mr. JAMES, and Mr. KNIGHT.

17. ADVANCED ALTERNATING CURRENTS.—*Four times a week; second semester.* Professor PAINE, Mr. FISK, Mr. JAMES, and Mr. KNIGHT.

24. ELECTRICAL ENGINEERING LABORATORY.—Advanced alternate current testing. *Twice a week; first semester.* Asst. Professor BIEGLER, Mr. MOORE, Mr. DAVIS.

25. DIRECT CURRENT APPARATUS.—Electric and magnetic circuits; direct current generators and motors. *Four times a week; first semester.* Mr. JAMES, Mr. FISK, Mr. KNIGHT.

26. ALTERNATING CURRENTS.—Mathematical and graphical treatment of periodic currents; phenomena in transmission lines and transformers. *Four times a week; second semester.* Mr. JAMES, Mr. FISK, Mr. KNIGHT.

27. ELECTRICAL ENGINEERING LABORATORY.—*Twice a week; second semester.* Assistant Professor BIEGLER.

75. Electrical Engineering Laboratory.—Direct current laboratory accompanying Electrical Engineering 25. *Twice a week; first semester.*
Asst. Professor Biegler, Mr. Davis.

76. Electrical Engineering Laboratory.—Determination of the flux and E. M. F. waves of alternators. Alternating current circuits, instruments. *Twice a week; second semester.* Assistant Professor Biegler, Mr. Davis.

ENGLISH LANGUAGE AND LITERATURE

Students who enter upon graduate work with English as their major subject are required to give evidence of their ability to write good English. They must present the equivalent of fourteen hours of undergraduate work in English literature, the required college work in rhetoric, and the equivalent of four semesters of college work in a language other than English. After the first year of graduate work a knowledge of French and German is indispensable.

Students making English their minor may be admitted to such courses as in the judgment of the instructor in charge they are qualified to pursue.

The Degree of Master of Arts in English.—In addition to complying with the general rules of the Graduate School, candidates for the degree of Master of Arts in English must comply with the following rules of the Department of English: (1) they must choose a portion of their work from the group of courses described as "for graduates;" (2) must offer an elementary course in Anglo-Saxon; and (3) must take, besides the regular semester examinations in all their courses, a general examination, oral or written as the department may prescribe, which shall be a final test of the candidate's fitness and ability.

The Degree of Doctor of Philosophy in English.—Candidates for the degree of Doctor of Philosophy in English may expect to be examined on the entire field of the English language and literature. They are urged, furthermore, to acquaint themselves as fully as possible with the history and the philosophy of the period in which their main interest lies, and with the foreign languages and literature most closely related to English in that period.

Courses for Graduates

101. Research in Special Periods.—Competent graduate students are encouraged to seek the advice and assistance of the Department of English and to submit to the Department plans for study in the language or literature of the periods mentioned below.

A. Anglo-Saxon Language and Literature.
Professor Dodge and Dr. Zeitlin.

B. Thirteenth and Fourteenth Centuries. Assistant Professor Jones.

C. Sixteenth Century. Professor Dodge.

D. Seventeenth Century. Assistant Professor Baldwin.

E. Eighteenth Century. Assistant Professor Paul.

F. Nineteenth Century. Associate Professor Fulton.

106. English Literary Criticism from Dryden to Coleridge.—*Twice a week; both semesters. One unit.* Associate Professor Fulton.

[Not given in 1916-17.]

108. The English Epic in the Sixteenth, Seventeenth, and Eighteenth Centuries from the Point of View of Classical Theory.—*Twice a week; both semesters. One unit.* Associate Professor Fulton.

109. German and Scandinavian Influences on English Literature of the Eighteenth and Nineteenth Centuries.—*Twice a week; first semester. One unit.* Professor Dodge.

[Not given in 1916-17.]

110. Old English (Anglo-Saxon) Poetry.—*Twice a week; first semester. One unit.* Professor Dodge.

113. Historical Prose Syntax.—The forces, native and foreign, at work in the development of English prose style as far as it relates to sentence structure. *Twice a week; both semesters. One unit.* Dr. Zeitlin.

[Not given in 1916-17.]

114. The Development of the Essay.—An examination of the various types of the English essay with reference to continental influences and classical origins. *Twice a week; both semesters. One unit.* Dr. Zeitlin.

126. Ballads and Metrical Romances.—*Twice a week; both semesters. One unit.* Dr. Schoepperle.

127. Middle English.—Critical reading of Middle English texts. Assistant Professor Jones.

[Not given in 1916-17.]

128. Spenser and the Beginnings of the English Renaissance.—Special emphasis upon the persistence of certain mediaeval traditions reinforced by the Revival of Classical Learning. Consideration of Catholicism and Calvinism as sources of literary inspiration. *Twice a week; both semesters. One unit.* Assistant Professor Jones.

135. Problems in American Literature.—*Twice a week; both semesters. One unit.* Assistant Professor Paul.

136. The Transition from the Seventeenth to the Eighteenth Century: The Rise of Classicism. *Twice a week; both semesters. One unit.*

[Not given in 1916-17.] Assistant Professor Paul.

137. Prose Writers of the Nineteenth Century.—Studies in the relation of literature to social forces, with special attention to the works of Mill, Carlyle, Newman, Ruskin, Arnold, and Pater. *Twice a week; both semesters. One unit.* Professor Sherman.

[Not given in 1916-17.]

138. The Romantic Movement in England.—*Twice a week; both semesters. One unit.* Professor Sherman.

[Not given in 1916-17.]

Courses for Graduates and Advanced Undergraduates

A. Literature and Language

3. The Poetry of Milton.—Origins, forms, artistic and ethical values; Milton's place in English literary history. *Twice a week; second semester.* Assistant Professor Baldwin.

4. English Versification.—Theory of English rhythm and metre; his-

tory of the development of the forms of English verse. *Three times a week; first semester.* Dr. Creek.

5. Shakespeare.—Intensive study of a few plays, with special emphasis on *Hamlet. Three times a week; second semester.* Professor Dodge.

8-9. Old English (Anglo-Saxon).—Grammar; prose; short poems; *Beowulf.* (The first semester may be taken separately.) *Three times a week; both semesters.* Professor Dodge.

18. Modern English Grammar.—The structure of the sentence and its analysis into the parts of speech; the common grammatical categories; the peculiarities of English syntax. *Three times a week; second semester.* Dr. Zeitlin.

25-26. Chaucer and His Contemporaries.—(The first semester, devoted wholly to Chaucer, may be taken separately.) *Three times a week; both semesters.* Assistant Professor Jones.

27-28. Studies in the History of Journalism.—*First semester*: English Literary Periodicals and the Periodical Essay in the 18th Century. *Second semester:* The Magazine in America. *Twice a week; both semesters.* Assistant Professor Scott.

32. The Greater English Critics of the Nineteenth Century.—*Three times a week; second semester.* Associate Professor Fulton.

35-36. English Drama (exclusive of Shakespeare.)—A. (first semester), From the beginning to 1600; B. (second semester), From 1660 to 1700. (Either semester may be taken separately.) *Three times a week; both semesters.* Professor Dodge, Dr. Hillebrand.

37. Folk Lore.—The elements of imaginative fiction. Origins of the lyric and drama. Primitive satire and gnomic literature. Superstitions surviving in English literature. *Twice a week; first semester.* Dr. Schoepperle.

38. The Arthurian Tradition.—The historical Arthur. Celtic influences. Old French Romances (in translation). The tradition in England from the early romances to the present time, with especial attention to Malory and Tennyson. *Twice a week; second semester.* Dr. Schoepperle.

39. Introduction to the Literature of the Middle Ages.—The relations of English and continental literature to the fourteenth century. *Three times a week; second semester.* Dr. Creek.

41-42. Teachers' Course.—Methods of teaching English literature and composition in the high school. (Either semester may be taken separately. This course, while open to graduate students, is not credited toward advanced degrees.) *Twice a week; both semesters.* Assistant Professor Paul.

45. The Development of the Modern Drama.—Dramatic tendencies in the Eighteenth and Nineteenth centuries, both in England and on the Continent; representative readings, and lectures from the standpoint of comparative literature. *Three times a week; first semester.* Dr. Hillebrand.

50. Celtic Literature in English Translation.—Irish, Scotch-Gaelic, and Welsh literatures, with special attention to the Cuchulainn and Ossianic cycles of romance, and the Mabinogron. Celtic tradition in English literature. *Twice a week; first semester.* Dr. Schoepperle.

[Not given in 1916-17.]

B. Rhetoric

15-16. Advanced Newspaper Writing.—The larger problems in reporting; application of principles of history, economics, and political science to current public events; editing; editorial writing. *Three times a week; both semesters.*
Assistant Professor Scott.

17. Advanced Composition.—Practice writing, with special emphasis on the study of structure; criticism of current periodical literature; the development of material for reports, magazine articles, etc. (Open to a limited number of students, and only on recommendation.) *Three times a week; second semester.*

ENTOMOLOGY

The prerequisite for graduate work in entomology is two years of undergraduate biology, of which one year should be zoology. Entrance upon major work in entomology requires the equivalent of entomology 15 or its equivalent. A reading knowledge of French and German is necessary at least by the beginning of the second year.

Courses for Graduates

102. Research in the Morphology and Embryology of Insects.—*Twice a week; both semesters. One or two units.* Assistant Professor Folsom.

108. Research in Economic Entomology.—*Once or twice a week; both semesters. One or two units.*
Professor Forbes and Assistant Professor Folsom.

109. Research in Systematic Entomology.—*Five times a week; both semesters. One or two units.* Associate Professor MacGillivray.

Courses for Graduates and Advanced Undergraduates

8. Economic Entomology.—Field, laboratory, insectary, library, and manuscript work, with practice in some of the special operations of economic entomology. *Three times a week; both semesters.* Assistant Professor Folsom.

10. Taxonomy of Immature Insects.—A study of the external form of immature insects and the identification of as many species as possible. *Five times a week; first semester.*
Associate Professor MacGillivray and Dr. Mosher.

11. Classification of the Coccidae.—Methods of preparing scale insects for study, the identification of genera and species, and discussion of their morphology, metamorphosis, and phylogeny. *Five times a week; second semester.*
Associate Professor MacGillivray and Dr. Mosher.

12. Current Literature.—*Once a week; both semesters.*

14. Advanced Economic Entomology.—Personal work, under direction, in the insectary, field, and library, with assigned problems in economic entomology, involving observation, experiment, and inference, note making, record keeping, and the preparation of manuscript. *Twice a week; first or second semester, and six weeks of summer vacation.*
Professor Forbes and Assistant Professor Folsom.

15. Introductory Course.—Lectures on the metamorphosis and develop-

ment of insects, characteristics of the orders, suborders, and more important families, and illustrations of the habits of representative species; quizzes, field collections, and laboratory studies on the anatomy of immature and adult insects, the identification of special adaptive structures, and the classification of insects. Not open to students who have had courses 2 and 3. Those who have had only one of these courses may take this course for a half credit only. *Five times a week; first semester.*

Associate Professor MacGillivray and Dr. Mosher.

17. Insect Organogeny.—Laboratory studies on the more important systems of adult and immature insects. *Three times a week; both semesters.*

Associate Professor MacGillivray and Dr. Mosher.

18. Insect Taxonomy.—Laboratory studies of the more important structures used in the classification of insects and the identification of a representative collection of insects. *Five times a week; both semesters.* Dr. Mosher.

FRENCH

See Romance Languages

GEOLOGY

For graduate work in geology the student must have a sound elementary training in the general principles of the science, and must have done advanced work in at least one of its branches. Except in unusual cases, which will be decided on their merits, at least 20 hours of geology and two weeks or more of field experience will be required. Graduate students with adequate technical preparation in other sciences may be admitted to graduate courses in certain subjects, such as crystallography and the history of organic evolution.

Courses for Graduates

101. Advanced Crystallography.—The methods used in measuring, projecting and calculating crystal forms, and determining the physical properties of crystallized bodies. *Twice a week; both semesters. One unit.*

Professor Bayley.

102. Igneous Petrography.—Lectures and laboratory work on the igneous rocks, including identification of types, classification and relationships. *Twice a week; both semesters. One unit.* Professor Bayley.

[Not given in 1916-17.]

103. Metamorphic Petrography.—Microscopic study of the metamorphic rocks and the interpretation of their origin. *Twice a week; both semesters. One unit.* Professor Bayley.

[Not given in 1916-17.]

105. Paleontologic Problems.—The study of fossil invertebrates, either by zoological groups or by geological horizons. *One to three times a week; both semesters. One unit.* Associate Professor Savage.

107. Structural Problems.—Structural interpretation of selected districts; based on geologic maps and other field data. *Once a week; both semesters. One unit.* Professor Blackwelder.

[Not given in 1916-17.]

108. Ore Deposition.—Problems in the origin of ore deposits, as illustrated by selected mining districts. *Three times a week; both semesters. One unit.*
Professor Bayley.

125. Sedimentation.—The interpretation of sedimentary rocks in terms of their origin. *Twice a week; both semesters. One unit.*
[Not given in 1916-17.] Professor Blackwelder.

126. Historical Problems.—Critical study of important questions of geologic history. *Twice a week; both semesters. One unit.*
[Not given in 1916-17.] Professor Blackwelder.

135. Research.—Individual work under the supervision of members of the staff in their respective fields. *Once a week; both semesters. One to four units.* Professor Blackwelder, Associate Professor Savage, Dr. Rich.

136. Seminar in Physical Geology.—Special problems in mineralogy, petrography, economic geology, metamorphism and related subjects. *Once a week; both semesters. One unit.* Professor Bayley.

137. Seminar in Historical Geology.—Special problems in historical geology, paleontology, correlation and allied subjects. *Once a week; both semesters. One unit.* Professor Blackwelder and Associate Professor Savage.

Courses for Graduates and Advanced Undergraduates

6. Optical Mineralogy.—An introduction to the courses in petrography. *Three times a week; first semester.* Professor Bayley.

7. Petrography.—The principles learned in course 6 are applied to the study of rocks. *Three times a week; second semester.* Professor Bayley.

9. Invertebrate Paleontology.—A study of invertebrate fossils, their classification and relationships. *Five times a week; first semester.*
Associate Professor Savage.

15. Structural Geology.—*Three times a week; first semester.*
Professor Blackwelder.

16. Stratigraphy.—The sequence of rock formations in North America, and their index fossils. *Five times a week; second semester.*
Associate Professor Savage.

23. Physiography of the Lands.—The making of topographic features as controlled by such factors as climate, and rock structure. Physiographic history. Two Saturday field trips. *Three times a week; second semester.* Dr. Rich.

31. Geology of Oil and Gas.—Origin and relations of the natural hydrocarbons; their distribution both geographically and in the stratigraphic column. *Three times a week; second semester.* Mr. Kay.

41. Advanced Field Geology.—For 1917 the field will probably be Eastern Wyoming. Ten weeks in summer. Party limited to 10, approved in advance.
Professor Blackwelder.

GERMANIC LANGUAGES AND LITERATURE

German

Students desiring to take German as a major are required to have finished successfully a four years' course of undergraduate work in German, comprising a minimum of twenty-eight semester hours of credit. They are also required to be familiar with the principal works of the writers of the classical and modern periods of German literature, to show a general knowledge of the history of German literature and to be able to follow lectures in the German language.

Of collateral subjects, a reading knowledge of Latin and French is required. It is desirable that candidates for the degree of Ph.D. have some knowledge of Greek. All students are to have had a course in German history.

Courses for Graduates

101. Seminar in Germanic Philology.—The primary object is to give training in original research. The result of the work, when of value, may be published in the *Journal of English and Germanic Philology. Once a week; both semesters. One unit.* Professor Goebel.

103. Introduction to the Historical Study of the Germanic Languages.—History of German Philology. Comparative Grammar of the Old Germanic dialects. *Twice a week; second semester. One unit.* Professor Goebel.

104. Gothic.—An introductory study of its grammar and literature. *Twice a week; first semester. One unit.* Professor Goebel.

105. Old High German.—Grammar and interpretation of the oldest literary documents. *Three times a week; first semester. One unit.* Dr. Williams.

109. Goethe's and Schiller's Philosophy.—*Twice a week; both semesters. One unit.* Professor Goebel.

110. Early German Drama.—The development of the German drama up to the Reformation, including the medieval religious drama, the Shrovetide plays and the beginnings of the Humanistic drama. *Twice a week; first semester. One unit.* Assistant Professor Brooks.

113. German Literature of the Fifteenth and Sixteenth Centuries.—Survey of the literature on the background of the general history of the time. Luther and the Reformation, Mastersingers and Folksong, the Reformation drama. Hans Sachs, Brant, Fischart, the chap books, the English comedians. *Twice a week; second semester. One unit.* Assistant Professor Brooks.

115. History of German Literature During the Nineteenth Century.—Lectures and reports. *Twice a week; both semesters. One unit.* Professor Lessing.

116. Medieval German Literature with Reference to Political, Religious, and Social History.—Research course. *Twice a week; both semesters. One unit.* Professor Lessing.

[Not given in 1916-17.]

117. History of German Literature During the Eighteenth Century.—*Twice a week; both semesters. One unit.* Professor Goebel.

[Not given in 1916-17.]

118. The German Drama Since Schiller.—Research course. (The subject for 1916-17 will be Grillparzer, Ludwig, Hebbel.) *Twice a week; both semesters. One unit.* Professor Lessing.

119. The German Novel.—Research course. *Twice a week; both semesters. One unit.* Professor Lessing.

[Not given in 1916-17.]

121. Walther von der Vogelweide.—Lectures and interpretations. *Twice a week; second semester. One unit.* Professor Goebel.

[Not given in 1916-17.]

121b. Nibelungenlied.—Lectures and interpretations. *Twice a week; second semester. One unit.* Professor Goebel.

125. History of the German Language.—Historical and critical study of the evolution of the forms, syntax and lexicography of the High German literary language. *Three times a week; second semester. One unit.* Dr. Green.

Courses for Graduates and Advanced Undergraduates

8. Schiller.—The life of Schiller; *Wallenstein* and other selections. *Three times a week; first semester.* Professor Lessing.

19a-19b. Goethe's Faust.—The Faust legend and early Faust books and plays; the genesis of Goethe's *Faust;* reading of both parts. *Twice a week; both semesters.* Professor Goebel.

[Not given in 1916-17.]

39a-39b. Goethe-Schiller.—Interpretation of Goethe's poems. Goethe's *Tasso* and Schiller's *Ueber naive und sentimentalische Dichtung. Twice a week; both semesters.* Professor Goebel.

[Not given in 1916-17.]

11. German Literature after the Reformation.—Lectures; recitations; reports on assigned reading. *Three times a week; second semester.* Professor Lessing.

26. German Literature before the Reformation.—Lectures; recitations; reports on assigned readings. *Three times a week; first semester.* Professor Lessing.

27. Lessing.—The life of Lessing; *Nathan der Weise, Emilia Gallotti* and other selections. *Three times a week; second semester.* Professor Lessing.

29. Advanced Prose Composition.—Themes on Germany and German life, based on suitable reading, discussed in German. *Three times a week; both semesters.* Dr. Koller.

31. Middle High German.—Grammar and readings. *Twice a week; first semester.* Professor Goebel.

32. History of Germanic Civilization.—Readings; lectures; discussions. *Three times a week; first semester.* Assistant Professor Brooks.

The Scandinavian Languages

Prepartion for major graduate work in the Scandinavian languages or literature must include a good reading knowledge of one of the Scandinavian languages and systematic work in the undergraduate courses in Scandinavian.

Any graduate student in language may, however, be admitted to the purely philological courses.

Courses for Graduates

101. Old Norse.—Introduction to the language as a member of the Germanic group. Reading of the *Prose Edda. Twice a week; both semesters One unit.* Associate Professor Flom.

103. Old Swedish.—Introduction to the language. Noreen's *Altschwedische Grammatik* and *Lesebuch. Twice a week; second semester. One unit.* Associate Professor Flom.

110. Advanced Old Norse.—Critical study of the lays of the *Elder Edda* and selections from the *Speculum Regale (Konungs Skuggsjá). Twice a week; both semesters. One unit.* Associate Professor Flom.

[Not given in 1916-17.]

140. Early Scandinavian Paleography.—Lectures and practical work with the oldest manuscripts. The work is based on the facsimiles and photographs of manuscripts in the Scandinavian Collection of the University library. *Twice a week; second semester. One unit.* Associate Professor Flom.

[Not given in 1916-17.]

150. Research.—Special problems in Scandinavian philology or literature. *Twice a week; first semester. One to two units.* Associate Professor Flom.

Courses for Graduates and Advanced Undergraduates

14. History of Old Norse Literature.—Lectures. The mythical lays, the court poetry, the sagas, the ballads. *Twice a week; first semester.* Associate Professor Flom.

16. Introduction to the History of Early Scandinavian Culture.—Lectures on the civilization of Scandinavia from the Stone Age down to the close of the Viking Age, 1000 A.D. *Twice a week; second semester.* Associate Professor Flom.

Comparative Philology

For Graduates and Advanced Undergraduates

1. Introduction to the Study of Language.—Phonetics; the development of forms of speech; dialects and the spread of languages; the study and teaching of languages. *First semester; three times a week.* Assistant Professor Bloomfield.

2. Comparative Philology of the Indo-European Languages.—Greek, Latin, and the Germanic languages, including English. *Second semester; twice a week.* Assistant Professor Bloomfield.

3. Elementary Sanskrit.—Reading and Grammar. *First semester; three times a week.* Assistant Professor Bloomfield.

4. Elementary Sanskrit.—Continuation of 3. *Second semester; three times a week.* Assistant Professor Bloomfield.

GREEK

[See Classics.]

HISTORY

Graduate work in history requires two years of college work in this subject, or sixteen semester hours, which should ordinarily include introductory courses in European and American history. Linguistic preparation is important especially in French and German history. For medieval history some knowledge of Latin is essential, and Spanish is useful for certain fields of American history.

Advanced courses in history at the University of Illinois are of three kinds: (1) Courses for information and guidance in general reading. (2) Instruction in methodology, histroriography, and bibliography. A part of this work (in course 103) is required of all graduate students in history during their first year. (3) Seminar courses for the study of special fields with a view primarily to training in the methods of historical criticism and research.

Illinois Historical Survey.—Historical students have an opportunity to pursue research in western history in connection with the Illinois Historical Survey, which is an organization for the purpose of carrying on systematic studies in the history of Illinois.

Attention is also called to the fact that the University of Illinois has for some time co-operated with the Illinois State Historical Society and the Trustees of the State Historical Library, in the gathering and editing of archive material. As a result of this relation instructors and graduate students in the department have contributed from time to time to the publications of these state organizations and have been given useful training in the study of manuscript as well as printed material.

Higher Degrees in History: The following statement regarding the specific requirements for higher degrees in History is subject to the general requirements of the Graduate School.

Master of Arts

In addition to meeting the general tests in the specific courses taken, each candidate is required to pass a general oral examination, and written examinations in two of the following fields: Ancient History; Medieval History of Continental Europe; Modern History of Continental Europe; English History; American History. Candidates for this degree are expected to have a general knowledge of historical bibliography and methodology (see course 103).

Doctor of Philosophy

Major Requirements.—A candidate who selects history as his major subject may offer himself for examination in any four of the fields indicated below, stating also the particular field among these four in which he wishes to specialize and in which his thesis is to be written:

1. Ancient history (with special reference to Greece and Rome). 2. Medieval history and institutions of continental Europe, to the close of the thir-

teenth century. 3. Continental Europe from 1300 to 1648. 4. Continental Europe and its dependencies since 1648 (except as included in 5 and 6). 5. The history of England and its dependencies (not including America before 1783). 6. American history (except as included in 5, and with primary reference to the United States). This enumeration of fields is not to be regarded as excluding the possibility of accepting others as may be determined by the department in individual cases.

Minor Subjects.—A candidate for the doctorate in history may select as his first minor one of the divisions of the field of history listed above which is not offered as a part of his major. He should preferably, however, select his minors from subjects offered by other departments. The following list of suitable minors is intended to be suggestive rather than exhaustive or compulsory.

I. In Political Science.—(Any two acceptable for a first minor; any one, for a second minor): 1. International law and diplomacy. 2. Modern government. 3. Municipal government. 4. Constitutional and administrative law and jurisprudence. 5. Political theory.

II. In Economics and Sociology.—Any two acceptable for a first minor; any one, for a second minor: 1. Economic history. 2. Economic theory. 3. Public and private finance. 4. Social reform. 5. Principles of sociology.

III. In Philosophy and Education.—(Any two acceptable for a first minor; any one, for a second minor): 1. History of ancient and medieval philosophy. 2. History of modern philosophy. 3. History of education.

IV. In Literature.—Some division of the history of literature which may be either the comparative literature of a limited period or the literature of a particular country for a more extended period as may be agreed upon in each case.

Courses for Graduates

101. Seminary in American History.—Bibliography; practice in the solution of typical problems; reports on the progress of individual investigations by instructors and students. *Two hours, once a week; both semesters. One to two units.* Professor Greene and others.

In connection with this course, advice and direction in research are offered in various fields as follows:

A. American history before 1789. Professor Greene.

B. American history since 1789. Assistant Professor Robertson, Dr. Cole.

C. The history of the west. Professor Alvord.

D. American church history. Professor Greene.

E. Latin-American history. Assistant Professor Robertson.

102. Studies in English History.—Selected problems from the history of England in the later middle ages and the early modern period. *Twice a week; both semesters. One unit.* Professor Larson.

103. Introduction to Historical Method and Historiography.—Selected problems in various fields; studies of representative historians, including readings in French and German historical literature. Required of all candidates for

an advanced degree in history who do not present evidence of similar training elsewhere. *Twice a week; both semesters. Half unit.*

Associate Professor LYBYER and others.

104. RESEARCH IN EUROPEAN HISTORY.—Advice and direction are offered by members of the department as follows:

A. Medieval history. Professor LARSON.
B. Modern history of Continental Europe. Associate Professor LYBYER.
C. English history. Professor LARSON.
D. Renaissance and Reformation. Dr. JONES.
E. Asiatic Relations. Professor GREENE, Associate Professor LYBYER.

Both semesters. One to two units.

105. STUDIES IN THE HISTORY OF THD WEST.—The special subject for 1916-17 will be The French Colonization of the Mississippi Valley. *Once a week; both semesters. One unit.* Professor ALVORD.

111. SPANISH-AMERICAN RELATIONS.—The relations of the Latin-American States with Europe and the United States. An intensive study of such topics as the Monroe Doctrine, the development of international trade, etc. *Once a week; both semesters. One-half to one unit.* Assistant Professor ROBERTSON.

[Not given in 1916-17.]

112. STUDIES IN AMERICAN RELIGIOUS HISTORY.—Questions of Church and State. *Once or twice a week at the option of the instructor; both semesters. One unit.* Professor GREENE.

[Not given in 1916-17.]

Courses for Graduates and Advanced Undergraduates

4. CONSTITUTIONAL HISTORY OF ENGLAND.—During the first semester the emphasis is placed on institutional origins; in the second semester particular attention is given to modern constitutional practice. *Three times a week; both semesters.* Professor LARSON.

7. THE REVOLUTIONARY AND NAPOLEONIC ERA IN EUROPE.—*Three times a week; first semester.* Associate Professor LYBYER.

[Not given in 1916-17.]

8. CIVILIZATION IN THE MIDDLE AGES.—The religious, economic, and intellectual development of medieval society. *Twice a week; first semester.*

Professor LARSON.

9a-9b. EUROPEAN SOCIETY IN THE ERA OF THE RENAISSANCE AND THE REFORMATION.—The transition from medieval to modern ideals. *Twice a week; both semesters.* Dr. JONES.

11. ANCIENT HISTORY.—Introduction to the methods of research in Greek and Roman history. *Three times a week; second semester.*

Professor OLDFATHER.

13. THE AMERICAN REVOLUTION, 1760-1783.—Colonial institutions on the eve of the Revolution; the controversy with the Mother Country; war and diplomacy; the transition from provincial to republican institutions. *Three times a week; first semester.* Professor GREENE.

14a. American Constitutional Development to 1789.—*Three times a week; first semester.*

[Not given in 1916-17.]

14b. American Constitutional History.—The development of the written and unwritten constitution since 1789. *Three times a week; second semester.*

Dr. Cole.

15. The Civil War and the Reconstruction (with a preliminary survey of the forces which brought on the conflict).—*Three times a week; second semester.* Dr. Cole.

16. The History of the Exploration and Colonization of the West.—First semester: The Mississippi Valley from the beginning of the Spanish explorations to the close of the War of 1812. Second semester: The development of the Mississippi Valley since 1815 and the progress of Westward expansion to the Pacific. *Twice a week; both semesters.* Professor Alvord.

19. France in the Feudal and Later Middle Ages.—*Twice a week; second semester.* A reading knowledge of French is desirable. Dr. Jones.

20a. Europe in the Nineteenth Century from the Congress of Vienna in 1815 to the Formation of the German Empire in 1871.—International relations; political, social, and economic development. *Three times a week; first semester.* Associate Professor Lybyer.

20b. Europe Since 1871.—International relations; European expansion; the Great War. *Three times a week; second semester.*

Associate Professor Lybyer.

21. The History of the United States Since the Civil War.—Historical introduction to contemporary American politics. *Three times a week; first semester.* Dr. Cole.

23. England in the Seventeenth Century with Special Reference to the Puritan Revolution.—The influence of Puritanism on the institutions and ideas of England and America. *Twice a week; second semester.* Dr. Pease.

26. History of the Latin-American Colonies.—The political, economic, social, and intellectual life of Spain during the period of discovery. The exploration, settlement and civilization of Spanish America and the Philippines. *Three times a week; first semester.* Assistant Professor Robertson.

[Not given in 1916-17.]

27. History of Latin-America from the War of Independence to the Present Time.—The national history of the leading Latin-American states with special attention to political parties, existing governments and relations with Europe and the United States. A study of the old regime in Texas, Mexico and California. *Three times a week; second semester.*

[Not given in 1916-17.] Assistant Professor Robertson.

29. The Far East.—The contact of Western nations with the Far East from the Portuguese establishments of the sixteenth century to the present time, with special reference to China and Japan. *Twice a week; second semester.*

Professor Greene.

30. The Ottoman Empire and the Near East.—The history of the lands

around the Eastern Mediterranean and of their international relations since the great Crusades. *Three times a week; first semester.*

Associate Professor LYBYER.

HISTORICAL CONFERENCES.—The instructors and graduate students whose principal work is in European history meet once a week in the European History Conference. During the past year the meetings have been devoted to the discussion of current historical problems. A similar conference on American history is held monthly in connection with History 101.

HORTICULTURE

At least two years of collegiate work in horticulture and allied subjects and specific preparation for the chosen topics are required for entrance upon major work in this department.

Courses for Graduates

103. OLERICULTURE.—Special problems in the structure, cultural requirements, and improvement of vegetables. *Both semesters. One to two units.*

Professor BLAIR, Professor LLOYD.

108. POMOLOGY.—Special problems in the relationship, adaptation, improvement, propagation, cultivation, pruning, protection, preservation, or marketing of small fruits and orchard fruits. *Both semesters. One to two units.*

Professor BLAIR. Professor CRANDALL.

115. FLORICULTURE.—The horticultural status of flowering plants; or special problems in the culture of greenhouse plants. *Both semesters. One to two units.* Assistant Professor DORNER, Dr. MUNCIE.

116. CHEMISTRY OF PLANT NUTRITION.—A course dealing with the occurrence of organic compounds in plants, and their significance in plant nutrition. Methods of analysis and investigation. Lectures, seminar, and laboratory. *Both semesters. Three-fourths to one and one-fourth units.* Dr. MUNCIE.

Courses for Graduates and Advanced Undergraduates

8. ORCHARDING.—A comprehensive study of pomaceous fruits and drupaceous or stone fruits. *Five times a week; first semester.* Professor CRANDALL.

12. EVOLUTION OF HORTICULTURAL PLANTS.—History, botanical classification, and geographical distribution of cultivated plants; modification under culture; theoretical causes and observed factors that influence variation, particularly food supply, climate, and cross-fertilization. *Three times a week; first semester.*

Professor CRANDALL.

18. EXPERIMENTAL HORTICULTURE.—Methods and difficulties in horticultural investigations; the planning of experiments; recording and interpretation of results. For advanced students preparing for experiment station work. *Five times a week; second semester.*

Professor BLAIR, Assistant Professor PICKETT, Mr. WATKINS.

HOUSEHOLD SCIENCE

The department is prepared to offer graduate work along two lines; one dealing with the applications of the biological and physical sciences to the prob-

lems of food and nutrition, the other, with the economic phases of the problems of the household. Whichever the student elects, she must offer, for entrance to graduate courses, the equivalent of an undergraduate major in Household Science in the University of Illinois. At present this major includes a minimum of nine hours' work with food, seven with textiles and clothing, and four with the house, with the addition of four elective hours which may be taken from any of the above groups. The student must also offer two years of chemistry, including general, organic, and quantitative, together with a year of biological science and a year of either economics or sociology.

Courses for Graduates

101. Home Economics.—A study of the origin and development of home economics, with particular reference to its industrial, educational, and sociological aspects. *Twice a week; first semester. One unit.* .. Professor Bevier.

102. Special Investigations.—Problems in the application of the principles of bacteriology, chemistry, and physiology to the ordinary processes used in the preparation of food; problems in nutrition. *Twice a week; both semesters. One unit.* Professor Bevier, Assistant Professor Wheeler.

103. Seminar.—Recent advances in nutrition. *Once a week; second semester. One-half unit.* Assistant Professor Wheeler.

104. Economic Problems of the Family Group.—An intensive study of the economic phases of selected problems of the household. *Twice a week; both semesters. One unit.* Dr. Perry.

Courses for Graduates and Advanced Undergraduates

4. Food and Nutrition.—An application of the principles of pure science to the problems of food and nutrition. The problems may be physiological, chemical, or bacteriological. *Five times a week; first semester.*
Assistant Professor Wheeler.

5. Dietetics.—*Three times a week; both semesters.*
Assistant Professor Wheeler.

20. Infant Nutrition.—*Twice a week; second semester.*
Assistant Professor Wheeler.

ITALIAN

[See Romance Languages.]

LATIN

[See Classics.]

MATHEMATICS

Students entering upon graduate study with a major in mathematics must have had twenty-five semester hours of undergraduate work in mathematics, including a year's course in calculus and a course in theory of equations, or in differential equations. They should be able to read German and French.

The students taking a first minor in mathematics are expected to have completed a course in calculus and are required to take four units of work beyond the calculus; students taking a second minor are required to complete at least two units of mathematical work beyond the calculus.

Courses for Graduates

100. SEMINAR.—*Three times a week; both semesters. One to two units.* Professor TOWNSEND, Professor MILLER, Professor RIETZ, Associate Professor SHAW, Assistant Professor SISAM, Assistant Professor EMCH, Assistant Professor CARMICHAEL.

101. FUNCTIONS OF REAL VARIABLES.—Three times a week; both semesters. *One unit.* Professor TOWNSEND.

102. FUNCTIONS OF A COMPLEX VARIABLE.—A general introduction to the theory of function of a complex variable. *Three times a week; both semesters. One unit.* Professor TOWNSEND.

[Not given in 1916-17.]

104. EXPANSIONS IN FUNDAMENTAL FUNCTIONS.—This course develops the theory of integral equations far enough to arrive at methods of expansion of arbitrary functions in terms of the characteristic functions of a given nucleus. *Three times a week; both semesters. One unit.* Associate Professor SHAW.

[Not given in 1916-17.]

105. CALCULUS OF VARIATIONS.—A study of the necessary and sufficient conditions for a maximum or minimum in simple and isoperimetric problems. *Three times a week; both semesters. One unit.* Dr. CRATHORNE.

[Not given in 1916-17.]

110. ELLIPTIC FUNCTIONS.—The elements of the theory with applications to geometry and mechanics. Introduction to the theory of the elliptic modular functions. *Three times a week; both semesters. One unit.*

[Not given in 1916-17.] Assistant Professor CARMICHAEL.

111. AUTOMORPHIC FUNCTIONS.—The first semester is devoted mostly to the group-theoretic side of the theory; the second semester is concerned with the function-theoretic developments and applications. *Three times a week; both semesters. One unit.* Assistant Professor EMCH.

113. THEORY OF LINEAR DIFFERENTIAL EQUATIONS.—Oscillation theorems for ordinary linear equations of the second order in real variables, general existence theorems and functions theoretic considerations for ordinary linear equations of order in complex variables; general theory of linear partial differential equations. *Three times a week; both semesters. One unit.* Assistant Professor CARMICHAEL.

120. ELEMENTARY THEORY OF GROUPS.—*Three times a week; both semesters. One unit.* Professor MILLER.

121. THEORY OF GROUPS.—This course presupposes about one year's work in group-theory. *Three times a week; both semesters. One unit.*

[Not given in 1916-17.] Professor MILLER.

122. MODERN ALGEBRA.—This course includes a consideration of the following topics: theory of matrices; system of linear equations; bilinear and quadratic forms; properties of polynomials; algebraic invariants; and elemen-

tary divisors. *Three times a week; both semesters. One unit.* Dr. KEMPNER.

124. THEORY OF NUMBERS.—*Three times a week; both semesters. One unit.* [Not given in 1916-17.] Dr. WAHLIN.

129. THEORY OF STATISTICS.—The general methods of statistical investigation and the application of the principles developed to problems in economics, sociology, and biology. *Three times a week; both semesters. One unit.* [Not given in 1916-17.] Professor RIETZ.

130. INVARIANTS AND HIGHER PLANE CURVES.—Special study is made of curves of the third and fourth order. *Three times a week; both semesters. One unit.* Assistant Professor SISAM.

131. ALGEBRAIC SURFACES.—The application of homogenous co-ordinates and the theory of invariants to geometry of three dimensions; the general theory of surfaces; the special properties of surfaces of the third and fourth order. *Three times a week; both semesters. One unit.* Assistant Professor SISAM. [Not given in 1916-17.]

132. PROJECTIVE GEOMETRY.—Axiomatic foundations, cross ratio, projective pencils and ranges, etc. Application to mechanics. *Three times a week; both semesters.* Dr. CRATHORNE.

135. DIFFERENTIAL GEOMETRY.—Applications of the calculus to the general theory of curves and surfaces based primarily in the use of Cartesian co-ordinates. Relation of the theory of surfaces to the theory of invariants of a pair of quadratic differential forms. *Three times a week; both semesters. One unit.* Assistant Professor SISAM.

141. VECTOR METHODS.—*Three times a week; both semesters. One unit.* Associate Professor SHAW.

142. GENERAL ALGEBRA.—*Three times a week; both semesters. One unit.* [Not given in 1916-17.] Associate Professor SHAW.

Courses for Graduates and Advanced Undergraduates

7, 9. DIFFERENTIAL AND INTEGRAL CALCULUS.—*Five times a week; first semester; three times a week, second semester.*

Professor TOWNSEND, Professor RIETZ, Associate Professor SHAW and others.

8. DIFFERENTIAL AND INTEGRAL CALCULUS.—This course may be counted for graduate credit by students whose major is chemistry. *Five times a week; first semester.* Professor MILLER.

10. THEORY OF EQUATIONS AND DETERMINANTS.—This course may be counted for graduate credit by students whose major is a subject other than mathematics. *Three times a week; first semester.* Professor MILLER.

16-17. DIFFERENTIAL EQUATIONS AND ADVANCED CALCULUS.—Ordinary and partial differential equations supplemented by the consideration of special topics of calculus not ordinarily included in a first course, particularly those of value in the applications of mathematics. *Three times a week; both semesters.* Professor TOWNSEND.

19. SOLID ANALYTICAL GEOMETRY.—*Three times a week; second semester.* Assistant Professor SISAM.

21. Method of Least Squares.—*Twice a week; first semester.*
Professor Stebbins.

30-31. Actuarial Theory.—Mathematical treatment of life contingencies; construction of life tables, and of monetary tables; valuation of policies to meet statutory requirements; mathematical theory of risk; distribution of surplus; preparation of annual reports; inheritance taxes; old age pensions; workmen's compensation; theory and practice of investing the funds of an insurance company. *Three times a week; both semesters.* Professor Rietz.

[Not given in 1916-17.]

32. History of Mathematics.—A general view of the historical development of the elementary subjects and an outline of the rise and growth of the higher mathematics chiefly in the nineteenth century. *Twice a week; second semester.* Dr. Lytle.

40. Fundamental Concepts of Mathematics.—Development of the number concept; concepts of unity; aggregate, order and correspondence; irrationals and limits, transcendence of *e* and *n;* parallel axiom and non-euclidian geometries; ruler and compass constructions; function; logic of mathematics. *Twice a week; second semester.* Dr. Lytle.

[Not given in 1916-17.]

MECHANICAL ENGINEERING

The prerequisite for graduate work in mechanical engineering is the equivalent of the undergraduate course required for the degree of Bachelor of Science in mechanical engineering in the branches of the subject in which registration is desired.

Courses for Graduates

106. Heat Motors.—The advanced theory of the internal combustion motor, and of the steam turbine; the general principles and methods of refrigeration. *Twice a week; second semester. One unit.* Professor Goodenough.

107. Thermodynamics.—The general principles of thermodynamics and their application to the solution of engineering problems. *Twice a week; first semester. One unit.* Professor Goodenough.

109. Machine Design.—The general principles of rational design; the application of mechanics of materials. Individual problems. *Twice a week; either semester. One unit.* Professor Leutwiler.

112. Laboratory Investigations.—Special investigations of problems relating to the combustion of fuels, boiler economy, steam engines and turbines, and similar subjects. *Three times a week; both semesters. One and one-half units.*
Professor Richards and Associates.

114. Dynamics of Machinery.—Advanced problems; whirling and vibration of shafts; theory of governors; fly wheels; force and mass reduction; stresses in rotating masses. *Twice a week; both semesters. One unit.*
Professor Goodenough.

Courses for Graduates and Advanced Undergraduates

The following are accepted as minor courses for students who are not candidates for advanced degrees in mechanical engineering:

12. THERMODYNAMICS.—*Five times a week; second semester.*
Professor GOODENOUGH.

15. GAS POWER ENGINEERING.—Internal combustion engines; liquid and gaseous fuels and their combustion; gas producers. *Three times a week; first semester.* Professor RICHARDS.

26. HEATING AND VENTILATION.—The theory and the application of the principles of heating and ventilation to modern practice. *Three times a week; second semester.* Assistant Professor WILLARD.

30. MECHANICS OF MACHINERY.—Mechanisms and mechanical movements; cams, gears, valve gears, and quick-return motions; graphical constructions for displacement, velocity, and acceleration; kinetics of the steam engine mechanism and similar mechanisms. *Five times a week; second semester.* Mr. DENT.

32. POWER TRANSMISSION.—The theory and practice of power transmission by means of shafting, belts, ropes, cables, water, air, gas, and steam; the measurement and storage of power. *Three times a week; second semester.*
Professor RICHARDS.

43. ENGINEERING DESIGN.—Theory of machine design with application. *Five times a week; first semester* Professor LEUTWILER.

44. ENGINEERING DESIGN.—Study of the correct design and commercial application of special tools, fixtures, jigs, dies, and gauges used in modern high production manufacturing. *Twice a week; second semester.*
Professor LEUTWILER.

52. POWER PLANT DESIGN.—Study and design of some form of steam power plant. *Three times a week; second semester.* Professor LEUTWILER.

65. POWER LABORATORY.—Experiments on engines, turbines, gas engines, pumps, boilers, injectors, air compressors, hoisting appliances, heating apparatus, and refrigerating machines. *Three times a week; first semester.*

66. POWER LABORATORY.—Special research work in the mechanical engineering laboratory. *Twice a week; second semester.*

MECHANICS, THEORETICAL AND APPLIED

The prerequisite for graduate work in theoretical and applied mechanics is the equivalent of the undergraduate courses in theoretical and applied mechanics and in allied engineering subjects required for the degree of Bachelor of Science in engineering.

Courses for Graduates

101. ANALYTICAL MECHANICS.—The fundamental premises of mechanics; methods of treatment and attack; the more complex problems and applications. *Twice a week; first semester. One unit.* Assistant Professor MOORE.

102. RESISTANCE OF MATERIALS.—Advanced work on the properties of materials used in engineering construction and the methods of determining these properties. *Twice a week; second semester. One unit.*
Assistant Professor MOORE.

103. HYDRAULICS AND HYDRAULIC ENGINEERING.—The laws of hydraulic and their application to engineering problems; hydraulic power and its development; design and investigation. *Twice a week; second semester. One-half to one unit.*
Professor TALBOT, Assistant Professor MOORE.

104. Experimental Work in Laboratory of Applied Mechanics.—(a) Laboratory investigation in the materials-testing laboratory; (b) experimental work in hydraulic laboratory, and the study of the laws of hydraulics, the development of power, and various hydraulic problems. *Twice a week; both semesters. One-half to two units.* Professor Talbot, Assistant Professor Moore.

105. Experimental and Analytical Work in Reinforced Concrete.—Advanced work on the properties of reinforced concrete and on the principles of its action in structures. Research work in reinforced concrete. *Twice a week; both semesters. One and one-half units.* Professor Talbot.

Courses for Graduates and Advanced Undergraduates

(The courses are open only for minor credit to students not candidates for a degree in electrical engineering.)

1. Analytical Mechanics.—A course especially designed for students in Arts and Sciences. Lamb's *Statics* and Lamb's *Dynamics. Three times a week; first semester.* Mr. Ensign.

2. Analytical Mechanics.—A continuation of course 1. Lamb's *Dynamics. Three times a week; second semester.* Mr. Ensign.

10. Hydraulics.—The pressure and flow of water; its utilization as motive power; observation and measurement of pressure, velocity, and flow; power and efficiency: determination of experimental coefficients. Hoskins' *Hydraulics. Laboratory weekly; three times a week; second semester.* Assistant Professor Enger and others.

21. Analytical Mechanics.—Continuation of Theoretical and Applied Mechanics 20. Kinematics and kinetics. Maurer's *Technical Mechanics. Twice a week; first semester.* Mr. Boomsliter and others.

25. Resistance of Materials.—A briefer course than Theoretical and Applied Mechanics 20. (For students in architectural engineering, ceramic and chemical engineering, electrical engineering, and mining engineering.) Merriman's *Mechanics of Materials. Four times a week; first semester.* Assistant Professor Enger and others.

26. Analytical Mechanics and Hydraulics.—Kinematics, kinetics, and hydraulics; problems; experiments in the hydraulic laboratory. (For students in architectural engineering, electrical engineering, and mining engineering.) Maurer's *Technical Mechanics,* Hoskins' *Text-Book on Hydraulics. Laboratory weekly during the last half of semester. Four times a week; second semester.* Assistant Professor Enger and others

METEOROLOGY

[See Geology]

MINERALOGY

[See Geology]

MINING ENGINEERING

The prerequisite for graduate work in mining engineering is the equivalent of the undergraduate courses required for the degree of Bachelor of Science in mining in the branches of the subject in which registration is desired.

In addition to the regular University laboratories, the laboratory connected with the investigation of mining conditions in Illinois now being carried on

jointly by the Engineering Experiment Station through the Department of Mining Engineering, the State Geological Survey, and the United States Bureau of Mines, is available for graduate instruction.

Courses for Graduates

100. SEMINAR.—*Once a week; both semesters. One unit.*
Professor STOEK.

101. ADVANCED MINING METHODS.—Coal and ore fields of the United States; methods and economics of mining; utilization, marketing, storage, and transportation of coal and ores. *Twice a week; both semesters. One unit.*
Professor STOEK.

102. ADVANCED PREPARATION OF COAL AND ORES.—Settling ratios, laws of crushing; sorting vs. sizing; mill and washing problems. *Twice a week; both semesters. One unit.* Assistant Professor HOLBROOK.

103. HISTORY OF MINERS' ORGANIZATIONS.—*Twice a week; both semesters. One unit.* Professor STOEK.

104. MINING REPORTS.—Law of the apex, the classification of coal and ore lands; conservation of mineral resources; mine examination and report. *Twice a week; both semesters. One unit.* Professor STOEK.

105. WELFARE WORK AND EDUCATION AMONG MINE EMPLOYEES.—The organization and operation of mining institutes, night classes, welfare, mine rescue and first-aid work. *Twice a week; both semesters. One unit.*
Professor STOEK.

Courses for Graduates and Advanced Undergraduates

5. MINE VENTILATION.—*Three times a week; first semester.*
Professor STOEK.

9. PREPARATION OF COAL AND ORES.—*Three times a week; first semester.*
Assistant Professor HOLBROOK.

13. UTILIZATION OF FUELS.—*Twice a week; second semester.*
Assistant Professor HOLBROOK.

19. ORE AND COAL PREPARATION.—*Three times a week; first semester.*
Assistant Professor HOLBROOK.

21. MINE EXAMINATION AND VALUATION.—*Twice a week; first semester.*
Professor STOEK.

MUNICIPAL AND SANITARY ENGINEERING

The prerequisite for graduate work in municipal and sanitary engineering is the equivalent of the undergraduate courses required for the degree of Bachelor of Science in municipal and sanitary engineering in the branches of the subject in which registration is desired.

Courses for Graduates

102. WATER SUPPLY ENGINEERING.—Advanced work in water supply engineering will be arranged to suit the requirements of individual classes. *One to three times a week; first or second semester. One unit.*
Professor TALBOT.

103. SEWERAGE.—General sewerage design and construction, sewerage sys-

tems, and hydraulics of sewers, are examples of the topics taken up. *Once or twice a week; second semester. One unit.* Professor TALBOT.

106. WATER PURIFICATION, SEWAGE DISPOSAL, AND GENERAL SANITATION.—The design, construction, and operation of water purification plants and of sewage disposal works, and the study of existing plants. Experimental work on water filters, sewage tanks, etc.; garbage disposal and general sanitation. *Once a week; second semester. Half unit or more.* Professor TALBOT.

Courses for Graduates and Advanced Undergraduates

6a-6b. WATER PURIFICATION, SEWAGE DISPOSAL, AND GENERAL SANITATION.—Impurities in water supplies and methods and processes of removal; the various methods of sewage disposal; representative purification plants; garbage collection and disposal; sanitary restrictions and regulations and general sanitation. Lectures; seminar work; drafting. *Three times a week; first semester. Twice a week; second semester.* Professor TALBOT and Mr. BABBITT.

PALEONTOLOGY

[See GEOLOGY]

PHILOLOGY

[See CLASSICAL PHILOLOGY, under CLASSICS, COMPARATIVE PHILOLOGY under GERMANIC LANGUAGES, and ROMANCE PHILOLOGY, under ROMANCE LANGUAGES.]

PHILOSOPHY

Students entering upon graduate work in philosophy must have had a general course in the history of philosophy, a course in logic, and a general course in psychology.

Courses for Graduates

103. SEMINAR IN ETHICS.—British ethics from Hobbes to Sidgwick. *Twice a week; both semesters. One unit.* Professor DANIELS.

107a-107b-107c. HISTORY OF PHILOSOPHY.—a: Plato and Aristotle. *Twice a week; both semesters. One unit.*

b. Descartes, Spinoza, and Leibnitz. *Twice a week; first semester. One unit.*

c. Kant and Schopenhauer. *Twice a week; first semester. One unit.*

The subject for 1916-17 is 107a. Professor DANIELS.

108a-108b-108c. SEMINAR IN CONTEMPORARY PHILOSOPHY.—a: Idealism. *Twice a week; both semesters. One unit.*

b. Realism and pragmatism. *Twice a week; both semesters. One unit.*

c. The philosophy of Bergson. *Twice a week; both semesters. One unit.*

The subject for 1916-17 is 108b. Professor BODE.

Courses for Graduates and Advanced Undergraduates

3. HISTORY OF ANCIENT AND MEDIEVAL PHILOSOPHY.—*Three times a week first semester.* Professor DANIELS.

4. HISTORY OF MODERN PHILOSOPHY.—*Three times a week; second semester.* Dr. SHEPHERD.

7. Ethics.—The beginning and growth of morality; the fundamental questions of ethical theory; typical social and economic problems of the present. *Three times a week; second semester.* Professor Daniels.

11. Philosophy of Religion.—The philosophical interpretation of religious consciousness. Among the topics considered are: God; revelation; inspiration; dogma; prayer; faith; immortality; the problem of evil; the relation of morality and religion. *Twice a week; second semester.* Professor Daniels.

15. British Philosophers of the Eighteenth Century.—Locke, Berkeley and Hume. *Three times a week; first semester.* Professor Bode.

16. Philosophy of Pragmatism.—*Three times a week; second semester.* Professor Bode.

18. Philosophers of the Nineteenth Century.—A survey of philosophical tendencies in materialism, naturalism, idealism and pragmatism. *Three times a week; first semester.* Dr. Shepherd.

19. Rationalism and Religion in the Eighteenth and Nineteenth Centuries.—*Three times a week; first semester.* Dr. Shepherd.

PHYSICS

The prerequisite for graduate work in physics is a college course in general physics with a year's laboratory course in introductory physical measurements. The student who is to do major work in physics should also have had additional courses in physics or teaching experience, unless the training in his minor subjects, mathematics or chemistry, has been strong and complete. He should also have a knowledge of French and German sufficient to use references in these languages. The courses named below are those open for candidates for the Master's or Doctor's degree. A large part of the last year's work of the candidate for the Doctor's degree is investigational, along either the experimental or the theoretical side of physics. In addition to these major graduate courses, the courses in elementary dynamics, heat, light, electrical measurements, and introductory electrical theory, are arranged with certain additions for graduate credit. The intermediate courses on electricity and magnetism, heat and light (Physics 15, 16, 17) may be offered with certain additions by candidates for the master's degree and then generally only as minors.

Courses for Graduates

121. Recent Advances in Physics and the Electron Theory.—A series of lectures of a non-mathematical character describing and discussing some of the more recent discoveries in physics. Some of the topics last presented were: the molecular and atomic structure of matter, the universal occurrence of electrons; determination of the e/m and v of the electron, and of the ion; determination of the elementary charge of the electron by means of the fog method, by Brownian movement, by radio-activity. *Three times a week; second semester. Half-unit.* Associate Professor Knipp, Associate Professor Kunz.

[Not given in 1916-17.]

123. Sound.—The course includes discussion of wave motion, forced vibrations, the velocity and energy relations of sound waves, resonance, vibrations of

strings and organ pipes, etc. *Three times a week; second semester. Three-quarters unit.* Associate Professor WATSON.

124. CONDUCTION OF ELECTRICITY THROUGH GASES.—A laboratory course with collateral reading and discussions in which the student performs quantitatively with standard apparatus, together with such additional apparatus as he may find it necessary to construct, the classical experiments relating to discharge phenomena. In the second semester an original problem is taken up and carried to completion. *Three times a week; both semesters. One to two units.*

Associate Professor KNIPP.

126. PHYSICS COLLOQUIUM.—Weekly meetings of the instructors and advanced students of the department for the presentation and discussion of papers on current problems in physics. Attendance on this colloquium is expected of all the graduate students. *Once a week; both semesters. No credit.*

127a. ELECTRON THEORY.—Mathematical part, Seminar.—Theory of radiation of the black body. Entropy and probability. The energy quantum and its applications in the theory of the specific heat, the photoelectric and related effects. The students will present topics selected in advance so as to get acquainted with the actual problems in this field by means of the current literature. *Once in two weeks. First semester. One unit.* Associate Professor KUNZ.

127b. ELECTRON THEORY.—Physical part.—The method of physical intuition will be used throughout this course, avoiding deeper mathematical analysis, it is hoped, that the course will be of special interest to students in chemistry and general science. The subjects of the course are as follows: The Zeeman and corresponding electric phenomenon, electro-and magneto-optics; emission and absorption spectra, dispersion, photoelectricity, phosphorescence, chemical action of light and electrons, electron theory of metals, and of magnetism, constitution of the atom. *Twice per week, second semester. One unit.*

Associate Professors KUNZ and SCHULZ

131. INVESTIGATION OF SPECIAL PROBLEMS.—Advanced laboratory or design and calculation. A problem worked out with the advice and direction of the instructor. *Two to four times a week; both semesters. One to two units.*

Professor CARMAN, Associate Professors KNIPP, WATSON, KUNZ, Assistant Professor SCHULZ, and Dr. WILLIAMS.

132. MATHEMATICAL PHYSICS.—Special phases in theoretical physics.

132a. DYNAMICS.—Newton's equations, general methods of integration, potential-theory, potential of the ellipsoid, application to celestial mechanics, the principles of least constraint, of virtual work, of D'Alembert, of Hamilton, are some of the subjects in the first part of the course. In the second part, special problems of the hydrodynamics and of elasticity will be treated. *Three times a week; both semesters. Two units.* Associate Professor KUNZ.

132b. ELECTRODYNAMICS.—Lectures and collateral reading on the principles of this science. The potential theory applied to electrical and magnetic polarization; spherical harmonics, images and inversion, conjugate functions, elliptic coordinates and integrals, magnetic actions of currents, determination of coefficients of capacity, self and mutual induction, absolute measurements, Maxwell's theory with some applications in optics. *Four times per week, both semesters. Two units.* Associate Professor KUNZ.

132c. Thermodynamics and Kinetic Theory of Matter.—The two fundamental principles developed and applied to various physical and chemical phenomena; the theory of chemical equilibrium; the Nernst theorem; the direct method of Carnot's cycle together with the method of the thermodynamic potentials and the derived functions; Maxwell's theory of the distribution of velocities in a gas; Boltzman's H theory; the theory of radiation, especially Planck's theory of quanta. *Both semesters. One to two units.*

Associate Professor Kunz.

[Given in 1914-15; probably again in 1917-18.]

132d. Theory of Electrical Osciliation and Cylindrical Harmonics.—*Four times a week; both semesters. One to two units.*

[Not given in 1916-17.] Associate Professor Kunz.

132e. Elasticity and Hydrodynamics.—A discussion of selected problems of elasticity and hydrodynamics and especially problems of technical interest. The work requires advanced mathematics, but not advanced dynamics. The course has partly the character of a seminar; the current literature of physical and technical journals is used. *Twice a week; first semester. One unit.*

Associate Professor Kunz.

133. Seminar.—*Three or five times a week; both semesters. One to three units.*

Professor Carman, Associate Professors Knipp, Watson, Kunz, Assistant Professor Schulz.

Courses for Graduates and Advanced Undergraduates

4a-4b. Electrical and Magnetic Measurements.—A course of exact electrical and magnetic measurements with accompanying theory. There is a special section for graduate students of Chemistry the first semester. *Twice a week; both semesters.* Associate Professor Knipp.

14a. Introduction to Theoretical Physics.—Dynamics.—This course is intended to put in systematic form the fundamental facts and concepts of motion, mass and force, with discussion and solving of problems from pure and applied physics. *Three times a week; first semester.* Professor Carman.

*15. Electricity and Magnetism.—Recommended to students in non-technical courses who wish a knowledge of electricity and magnetism beyond the course in general physics. *First semester, two recitations or lectures and one three-hour laboratory exercise weekly.* Associate Professor Knipp.

*16. Heat.—Fundamental heat phenomena, the mechanical theory of heat and elementary thermodynamics. Laboratory experiments in thermometry, calorimetry, vapor pressure, expansion of bodies, transmission of heat, mechanical equivalent, etc. *Three times a week; first semester.*

Associate Professor Watson.

*17. Light.—Reflection, refraction, interference, diffraction and polarization; laboratory experiments on these phenomena, and the theory and use of telescopes, microscopes, refractometers, prism and grating spectroscopes and interferometers. *Twice a week; second semester.*

Associate Professor Schulz.

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*These courses may be taken for minor credit or as *first* year major credit only.

20. LIGHT.—Special phenomena; modern theories; readings in texts of Drude, Wood, and Preston. *Twice a week; first semester.*
Assistant Professor SCHULZ.

22. LIGHT-PHOTOMETRY.—The scientific principles and methods of photometry; the comparison of various light sources with standards; the determination of reflective power and transmission coefficients; spectrophotometry, etc. *Two to five times a week; first semester.* Assistant Professor SCHULZ.

23. SOUND.—The course includes a consideration of the origin, propagation, velocity, and interference of sound, the vibration of strings, rods, and gas columns, and the physical theory of music and speech. *Three times a week; second semester.* Associate Professor WATSON.

*24. PROPERTIES OF MATTER.—The fundamental properties of matter, weight, mass, gravitation, elasticity, viscosity, surface tension, and diffusion. Laboratory measurements including the use of the dividing engine, chronograph, etc. *Three times a week; second semester.* Dr. WILLIAMS.

25. HEAT.—Advanced laboratory work in heat involving mostly the theory and methods of measurement of temperatures by thermocouples, resistance thermometers and optical pyrometers. *Twice a week; second semester.*
Associate Professor WATSON.

30. INTRODUCTION TO THEORETICAL ELECTRICITY.—Electrical and magnetic phenomena discussed with calculus methods. This is a course for advanced students in physics, chemistry, mathematics and engineering. *Three times a week; second semester.* Associate Professor KNIPP.

31a-31b. SPECIAL PROBLEMS IN ADVANCED PHYSICAL MEASUREMENTS.—*Two or three times a week; both semesters.*
Professor CARMAN, Associate Professors KNIPP and WATSON, Assistant Professor SCHULZ and Dr. WILLIAMS.

PHYSIOGRAPHY

[See GEOLOGY.]

PHYSIOLOGY

The prerequisites for graduate work in physiology are three semester hours in histology, five semester hours in chemistry, and five in botany or zoology.

Courses for Graduates

100. PHYSIOLOGY OF SECRETION AND EXCRETION.—A study in the method of procedure in collecting the various secretions of mammals and a study of the factors controlling the flow of these juices. *Three times a week; both semesters. Three-quarter unit.* Assistant Professor BURGE.

101. JOURNAL CLUB.—Review of literature and discussion of investigation being carried on in the department. *Once a week; both semesters. One quarter unit.* Members of the staff.

103. RESEARCH.—*Three times a week; both semesters. One or two units.*
Assistant Professor BURGE.

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*These courses may be taken for minor credit or as *first* year major credit only.

Courses for Graduates and Advanced Undergraduates

1. Histology.—A microscopic study of the fundamental mammalian tissues. *Three times a week; first semester.* Dr. Beard.

2. Experimental Physiology.—Study of nerve, muscle, circulation, secretion, digestion, and metabolism. *Five times a week; second semester.* Assistant Professor Burge and Dr. Beard.

5. Physiology of Nutrition.—A study of the utilization of food material by the body in health under various conditions and in disease. *Twice a week; second semester.* Assistant Professor Burge.

6. Physiology of the Nervous System.—A study of the functions of the principal motor and sensory tracts of the mammal. *Once a week; first semester.* Assistant Professor Burge and Dr. Beard.

7. Investigation.—*Twice a week; both semesters.* Assistant Professor Burge.

8. Histology.—Microscopic anatomy of the organs. *Three times a week; second semester.* Dr. Beard.

POLITICAL SCIENCE

Graduate work in political science is conducted in the following special fields: (1) Political theory; (2) international law and diplomacy; (3) comparative government; (4) constitutional law, administrative law, and jurisprudence; (5) municipal administration.

To be admitted to take political science as a major subject, the student must have done at least 18 hours of undergraduate work in political science, economics, and history, not less than nine hours of which must have been in political science. To take political science as a minor he must have had at least nine hours' work in this field, including six semester hours in American government, and state and local government.

If a student making political science his major is taking both of his minors in other departments, one of them must be in history, economics, or sociology.

Several courses given in other departments are so closely related to those in political science that graduate students whose major is political science may be permitted on petition to take such courses as part of their major work. Attention is also called to the technical courses given by the Department of Municipal and Sanitary Engineering.

Courses for Graduates

101. History of Political Theories.—Political theories of Aristotle, Machiavelli, Hobbes, Locke, Montesquieu, Rousseau, and others; evolution of American political ideas. *Twice a week; first semester. One unit.*

[Not given in 1916-17.] Professor Garner.

102. The Nature of the State.—*Twice a week; first semester. One unit.* Professor Garner.

103. Seminar in Political Science and Public Law.—*Once a week; both semesters.* Members of the Department.

106. Special Topics in International Law.—The topics for 1916-17 relate to certain questions of war law arising during the present European war, such as the rights and duties of neutrals, contraband, right of search, capture, continuous voyage, transfers of flag, blockade, etc. *Twice a week; second semester. One unit.* Professor Garner.

112. Topics in Public Administration.—Comparative studies in national, and local administration. The topics vary from year to year. *Twice a week; first semester. One unit.* Professor Fairlie.

113. Topics in American State Government.—Position of the states in the American governmental system; organization and functions of state government agencies; and the formation and execution of public policy through state legislation and administration. *Twice a week; both semesters. One unit.* Assistant Professor Mathews.

Courses for Graduates and Advanced Undergraduates

4. Municipal Government.—*Three times a week; first semester.* Mr. Story.

5. Constitutional Law of the United States.—*Three times a week; first semester.* Mr. Cushman.

6. International Law.—*Three times a week; first semester.* Professor Garner.

7. American Diplomacy.—*Three times a week; second semester.* Assistant Professor Mathews.

9. Principles of Jurisprudence.—The nature and source of law; historical development and comparison of Roman law and the English legal system; English common law in the United States; relation between statutes and judicial decisions; classification of law. *Twice a week; second semester.* Professor Fairlie.

10. Administrative Law in the United States.—Administrative organization, separation of powers and delegation of legislative powers; nature and scope of administrative power; administrative procedure and methods of enforcing governmental commands; remedies of the individual against unlawful official action. *Three times a week; second semester.* Mr. Cushman.

11. Constitutional Aspects of Social and Industrial Problems.—The police power; constitutional limitations upon legislation concerning the public health and safety; the control of public service corporations and combinations of capital and labor. *Three times a week; first semester.* Mr Cushman.

12. National Administration in the United States.—A study of the President and his Cabinet; the executive departments and the administrative services of the national government, etc. *Three times a week; second semester.* Professor Fairlie.

13. State Administration in the United States.—*Three times a week; first semester.* Assistant Professor Mathews.

14 Political Parties.—A study of the development of political parties and their organization and influence on the government mainly of the United States, and Great Britain, with attention to recent legislation on primaries and nomina-

tion methods in this country. *Twice a week; first semester.*

Professor FAIRLIE.

18. LEGISLATION IN THE UNITED STATES.—Nature of legislative power; principles of representation; legislative organization, procedure and practices; bill drafting; legislative reference bureaus; popular law making; tendencies in legislation. *Three times a week; second semester.* Mr. STORY.

21. BRITISH GOVERNMENT.—Political institutions in the United Kingdom and British Possessions. *Three times a week; first semester.* Professor FAIRLIE.

22. CONTINENTAL EUROPEAN GOVERNMENT.—A comparative study of the national political systems of France, Germany, Italy, Austria-Hungary and Switzerland. *Three times a week; second semester.* Professor GARNER.

28. PROBLEMS OF CONTEMPORARY POLITICS.—The initiative and the referendum; state socialism; universal suffrage; local self-government; judicial reform; the Monroe Doctrine, etc. *Twice a week; second semester.* Mr. STORY.

34. MUNICIPAL PROBLEMS.—Municipal administration in the United States and Europe: municipal organization and relations to the state; municipal ownership and regulation of public utilities; city planning and housing; police and sanitary administration; municipal finances. *Three times a week; second semester* Professor FAIRLIE.

PSYCHOLOGY

Graduate students who elect psychology as their major subject must have had standard courses, of university grade, both in general psychology and in the psychological laboratory. One general university course is the minimum requirement for graduate students who apply to the department for a minor subject.

Courses for Graduates

103. RESEARCH.—Experimental and historical investigations. *Both semesters. One half to two units.*

Professor BENTLEY, Dr. RUCKMICH, Dr. RAHN.

105. SEMINAR.—The discussion of current topics considered in their historical setting. *Once a week, two hours; both semesters. One-half unit.*

Professor BENTLEY.

Courses for Graduates and Advanced Undergraduates

5-6. COMPARATIVE PSYCHOLOGY.—Study of consciousness in the animal forms. Laboratory drill and research. *Twice a week; both semesters.*

Professor BENTLEY.

9. PHYSIOLOGICAL PSYCHOLOGY.—An empirical study of the psychophysical relationships. Lectures and discussions. *Three times a week; second semester.*

Dr. RAHN.

12-13. MINOR PROBLEMS.—The application of methods suitable to new problems. *Two to five times a week; both semesters.*

Professor BENTLEY, Dr. RUCKMICH.

14. SOCIAL PSYCHOLOGY.—The social consciousness, its factors and condi-

tions: the psychology of peoples *(Völkerpsychologie). Three times a week; first semester.* Dr. RAHN.

17. THE HISTORY OF PSYCHOLOGY.—*Twice a week; second semester.* Dr. RUCKMICH.

19-20. SYSTEMATIC PSYCHOLOGY.—The nature of psychological analysis; mental integration. *Three times a week; both semesters.* Dr. RUCKMICH, Dr. RAHN.

21-22. SPECIAL STUDIES.—Individual investigation for advanced students. *Three times a week; both semesters.* Professor BENTLEY, Dr. RUCKMICH, Dr. RAHN.

RAILWAY ENGINEERING

The prerequisite for graduate work in railway engineering is the equivalent of the undergraduate courses required for the degree of Bachelor of Science in railway engineering in the branches of the subject in which registration is desired.

Courses for Graduates

102. LOCOMOTIVE DESIGN.—Study and analysis of modern practice concerning steam pressure, compounding, superheating, etc. *Once a week; both semesters. One unit.* Professor GOSS.

106. LOCOMOTIVE OPERATION.—Study and determination of train resistance and locomotive tractive effort. The application of these and other matters in the establishment of tonnage ratings. *Once a week; both semesters. One unit.* Professor SCHMIDT and Assistant Professor SNODGRASS.

108. ELECTRIC RAILWAYS.—This course deals with the design, selection, and operation of electric railway equipment. *Once a week; both semesters One unit.* Assistant Professor BUCK.

110. RAILWAY LOCATIONS.—This course is essentially a study of the effects of the location of a railway upon its earning capacity. It deals with the engineering and economic problems met with in original location, as well as in the relocation and reduction of grades of existing lines. *Once a week; both semesters. One unit.* Mr. COMSTOCK.

Courses for Graduates and Advanced Undergraduates

6. LOCOMOTIVES.—*Four times a week; second semester* Professor SCHMIDT.

33. ECONOMIC THEORY OF RAILWAY LOCATION.—*Four times a week; second semester.* Mr. COMSTOCK.

64. ELECTRIC RAILWAY PRACTICE.—*Three times a week; first semester.* Assistant Professor BUCK.

65. ELECTRIC RAILWAY ECONOMICS.—*Four times a week; second semester.* Assistant Professor BUCK.

RHETORIC

[See ENGLISH.]

ROMANCE LANGUAGES AND LITERATURE

Before entering upon the study of Romance languages as a major for an advanced degree, the candidate must have had at least (a) three years of college work in French, together with a reading knowledge of Italian or Spanish; or (b) two years of college work in French and the same in Italian or Spanish. In addition a candidate must have had a good training in Latin, and must be able to read ordinary German prose.

Before entering upon the study of Romance Languages as a first or second minor, for an advanced degree, the candidate must have had a total of at least two years of college work in the language desired. He must also be able to read ordinary German prose.

French

Courses for Graduates

101. Old French Epic Literature.—Critical reading and interpretation of the greater national and courtly epics. Collateral study of the history of these types of medieval literature. *Twice a week; both semesters. One unit.*
Professor Oliver.

102. Old French Lyric and Prose Literature.—Critical interpretation of the earlier Old French didactic, chronicle, and lyric writers. Collateral study of the history of these types of medieval literature. *Twice a week; both semesters. One unit.* Professor Oliver.

[Not given in 1916-17.]

106. Early French Drama.—A study of the origins of the drama in France, and its development up to the Renaissance. *Twice a week; both semesters. One unit.* Associate Professor Carnahan.

103. Seventeenth Century Prose Writers.—French culture, society, and prose literature of the seventeenth century. The great preachers and moralists. Jansenism and Port Royal. The formation of the classic ideals. *Once a week; both semesters. Half unit.* Professor Oliver.

[Not given in 1916-17.]

104. Eighteenth Century Prose Writers.—Society, culture and prose literature of the eighteenth century. The attack upon the classic ideals. Growth of the revolutionary spirit. First movements towards romanticism. *Once a week; both semesters. Half unit.* Professor Oliver.

127. French Romanticism.—Origin and development of the romantic movement in France. *Twice a week; both semesters. One unit.*

[Not given in 1916-17.] Associate Professor Carnahan.

137. French Literary Criticism before the French Revolution.—History of criticism in antiquity and in the Italian Renaissance; the principal French critics. The development of classicism. *Twice a week; both semesters. One unit.* Assistant Professor Blondheim.

[Not given in 1916-17.]

139. French Literary Criticism in the Nineteenth Century.—Study of the leading critics and of the development of literary movements. *Twice a week; both semesters. One unit.* Assistant Professor Blondheim.

Courses for Graduates and Advanced Undergraduates

10a-10b. General Survey of French Literature.—An introduction to more extended study of special periods and authors. *Three times a week; both semesters.* Associate Professor Carnahan.

24a-24b. French Drama of the Seventeenth and Eighteenth Centuries.—Corneille, Racine, Molière, Marivaux, Sedaine, Beaumarchais. *Twice a week; both semesters.* Professor Oliver.

17a-17b. French Drama of the Nineteenth Century.—Hugo, Dumas, Augier, Sardou, Becque, Coppée, Brieux, Lavedan, Hervieu, Rostand, etc. Dramatic criticism. *Twice a week; both semesters.* Professor McKenzie.

45a-45b. French Realism.—Flaubert, Maupassant, E. and J. de Goncourt, Daudet, Zola. Lectures; collateral reading. Conducted in French if desired. *Twice a week; second semester.* Dr. Moore.

50a-50b. French Phonetics and Pronunciation.—Principles of phonetics; a detailed study of present-day pronunciation; practical exercises. *Once a week; both semesters.* Assistant Professor Blondheim.

Italian

Courses for Graduates

140. Italian Literature of the Thirteenth and Fourteenth Centuries.—Dante, Petrarch, Boccaccio. *Twice a week; both semesters. One unit.* [Not given in 1916-17.] Professor McKenzie.

143. Italian Literature of the Fifteenth and Sixteenth Centuries.—Special attention will be given to the romances of chivalry. *Twice a week; first semester. One unit.* Professor McKenzie.

146. Modern Italian Literature.—Critical study of important Italian writers of the nineteenth century. *Twice a week; second semester. One unit.* [Not given in 1916-17.] Professor McKenzie.

Course for Graduates and Advanced Undergraduates

2a-2b. Italian Literature.—Reading; composition; conversation. Introduction to the study of Dante. *Twice a week; both semesters.* Professor McKenzie.

Spanish

Courses for Graduates

132. The Novela of the Golden Age.—A study of the political and social conditions in Spain from 1560 to 1700 is followed by an examination of the various kinds of prose fiction produced in this period, with special attention to *Don Quixote* and the *Novelas Exemplares* of Cervantes. *Twice a week; both semesters. One unit.* Professor Fitz-Gerald.

[Not given in 1916-17].

133. Origin of the Spanish Novela and of the Comedia.—The development of Spanish prose fiction and of Spanish dramatic art for the period previous to the Golden Age. *Twice a week; both semesters. One unit.* Professor Fitz-Gerald.

134. The Spanish Ballad.—Types of the ballad. Lectures; collateral reading; reports. *Twice a week; both semesters. One unit.* Dr. Seymour.

135. The Modern Novel in Spain.—Development of the modern novel in Spain from the middle of the nineteenth century up to the present time. Comparative study of the development of the novel in Spain, France and Italy. *Twice a week; both semesters. One unit.* Dr. Seymour.

[Not given in 1916-17].

Course for Graduates and Advanced Undergraduates

11a-11b. The Spanish Drama of the Sixteenth and Seventeenth Centuries.—The principal dramatists of the classical period, especially Lope de Vega, Calderon, Tirso de Molina, and Ruiz de Alarcon. *Twice a week; both semesters.* Dr. Seymour.

ROMANCE PHILOLOGY

Courses for Graduates

171. Introduction to Romance Philology.—Historical Phonology and Morphology of the Romance languages. *Twice a week; both semesters. One unit.* Professor Fitz-Gerald.

[Not given in 1916-17].

175. Old French Phonology and Morphology.—Development of Old French from Vulgar Latin. *Twice a week; both semesters. One unit.* Assistant Professor Blondheim.

181. Origin and Formation of the Italian Language.—Study of thirteenth century texts. *Twice a week; second semester. One unit.* Professor McKenzie.

185. Oldest Monuments of the Spanish Language; Origins of Spanish Poetry.—Historical grammar and palæography; critical interpretation of texts. *Twice a week; both semesters. One unit.* Professor Fitz-Gerald.

195. Seminar.—Research work in preparation for theses in the field of the Romance languages. *Twice a week; both semesters. One unit.* Members of the Department.

SCANDINAVIAN LANGUAGES

[See Germanic Languages.]

SOCIOLOGY

Preparation for graduate work in sociology must include at least the equivalent of twelve semester hours in the social sciences, of which at least three must be in sociology, and three in the principles of economics. The remainder may be in any combination of these two subjects, or of history and political science.

Courses for Graduates

101. Sociological Method.—Adaptability to sociological investigation of certain methods described in Pearson's *Grammar of Science,* Wundt's *Method-*

enlehre, zweite abtheilung, Seignobos' *La Méthode Historique Appliquée aux Sciences Sociales,* Bernheim's *Historische Méthode,* Spencer's *Study of Sociology,* and Giddings' *Inductive Sociology. Three times a week; first semester. One unit.* Professor HAYES.

102. THE DEVELOPMENT OF SOCIOLOGY.—*One session, two hours, each week; both semesters. One unit.* Professor HAYES.

150. SEMINAR.—*One session of two hours each week; both semesters. One to two units.* Professor HAYES.

(Note: One of the three courses above described will be omitted in 1916-17; which one is omitted will depend upon the election of students.)

Courses for Graduates and Advanced Undergraduates

11. BASES OF SOCIAL THEORY.—*Twice a week; first semester.* Professor HAYES.

2. SOCIAL CONTROL.—The methods by which society shapes the conduct, opinions and sentiments of its members. *Three times a week; first semester.* Professor HAYES.

3. SOCIAL EVOLUTION.—(Anthropology). A study of the comparative method of dealing with questions of theory in the social sciences. *Three times a week; second semester.* Professor HAYES.

8. CHARITIES.—The evolution of modern organized philanthropy, public and private; causes and prevention of poverty; organization and management of charitable institutions. *Three times a week; first semester.* Dr. STEVENS.

9. CRIMINOLOGY.—Nature, causes, and treatment of the criminal; evolution of modern method of criminal procedure and penology; recent experiments and tendencies. *Three times a week; second semester.* Dr. STEVENS.

10. PROBLEMS OF POPULATION.—*Three times a week; first semester.* Dr. STEVENS.

12. LABOR PROBLEMS.—See Economics 12.

14. SOCIAL STATISTICS.—Social investigation and research. Social and community surveys. The verification of sociological laws and principles by means of statistical method. *Three times a week; second semester.* Dr. STEVENS.

15. THE FAMILY.—Evolution of the family and marriage; educational, moral, and political significance of the family at different stages of social development. *Twice a week; both semesters.*

[Not given in 1916-17.]

21. SOCIALISM AND ECONOMIC REFORM.—See Economics 21.

SPANISH

[See ROMANCE LANGUAGES.]

TRANSPORTATION

Transportation may be taken as a major or minor for the A. M. degree, and as a minor for the doctorate. No student will be admitted to the graduate courses in transportation unless he has a satisfactory acquaintance with the principles of economics and, in addition, such knowledge of the general problems

of transportation as is represented by the content of the undergraduate course on the transportation system of the United States.

Courses for Graduates

101. Railway Rate Policy.—An inquiry into the problems of railway rate making, from the points of view both of theory and practice. *Twice a week; first semester. One unit.* Professor Dewsnup.

[Not given in 1916-17.]

102. The Fiscal Administration of American Railways.—*Twice a week; second semester. One unit.* Professor Dewsnup.

[Not given in 1916-17.]

103. Foreign Railway Administration.—*Twice a week; first semester. One unit.* Professor Dewsnup.

104a. Standards of Railway Operation.—The work of this course requires a cycle of three years for its completion, though credit will be given for each semester's work. 104a deals with organization and maintenance standards, 104b with the freight service, 104c with the passenger service. *Once or twice a week, at the option of the instructor; second semester. One unit.* Professor Dewsnup.

Courses for Graduate and Advanced Undergraduates

2. Transportation Policy in Europe and the United States.—*Three times a week; second semester.* Professor Dewsnup.

7. Railway Organization.—*Twice a week; first semester.* Professor Dewsnup.

12. Freight Shipment.—*Twice a week; second semester.* Professor Dewsnup.

13. Railway Traffic Administration.—*Three times a week; first semester.* [Not given in 1916-17.] Professor Dewsnup.

22. Railway Train Service.—*Three times a week; second semester.* [Not given in 1916-17.] Professor Dewsnup.

26. The Economics of Railway Construction and Maintenance.—*Three times a week; second semester.* Professor Dewsnup.

17. Railway Terminal Management.—*Three times a week; first semester.* Professor Dewsnup.

ZOOLOGY

At least sixteen semester hours of college work in zoology are required for entering upon major graduate study in this subject. Under special circumstances advanced work in closely allied subjects may be accepted in lieu of the fourth semester's work in zoology. When zoology is chosen for a minor the courses listed for graduates and undergraduates must be preceded by at least one full year's undergraduate work in zoology.

For the prosecution of graduate study in zoology a reading knowledge of German and French is indispensable and familiarity with Latin and Greek is of great advantage.

Every candidate for the doctor's degree is expected to spend at least one summer in study at the seashore. To facilitate this plan an investigator's room has been provided at the Woods Hole Marine Biological Laboratory, where members of the department are afforded research facilities without cost to themselves. Application for the use of this room should be made to the head of the department early in the year. Similar facilities are afforded at the Harpswell Marine Laboratory.

Courses for Graduates

102. Selected Topics from Vertebrate Morphology.—The origin of vertebrates, segmentation of the head; morphology of special systems. *First semester. Half unit.* Professor Kingsley.

107. Parasitology.—Structure and life history of animal parasites; their relations to disease; origin and biological significance of parasitism. Conferences; assigned readings; demonstrations. *Twice a week; both semesters. One unit.* Professor Ward.

109-109a. Physiological Ecology.—The regulatory mechanism of organisms; neutrality, osmotic pressure, immunity, and temperature in relation to natural environments. 109 twice a week; 109a assigned readings and reports. *Second semester. Half unit each.* Assistant Professor Shelford.

110-110a. Economic Ecology.—Application of principles of physiology and ecology to problems of fisheries and pollution; insect pests and weather, forestry and conservation, etc. 110 *twice a week;* 110a assigned reading and reports. *Half unit each.* Assistant Professor Shelford.

[Not given in 1916-17.]

111. Experimental Ecology.—Repetition of published experiments in physiology and ecology. Student selects a topic on animal reactions or measurement of osmotic pressure, temperature, acidity, conductivity, etc., with modern apparatus. *Both semesters. One-half to two units.*
Assistant Professor Shelford.

115. Factors of Individual and Racial Development.—Experimental embryology; regeneration; heredity; variation; evolution. *Twice a week; both semesters. One unit.* Professor Zeleny.

117. Faunistic Zoology.—Problems in taxonomy and distribution; field work; conference; lectures. Work is favored by a natural history survey of the State now in progress at the University. Students have advantage of collections, library, apparatus and operation of this survey. *Twice a week; both semesters. One-half to two units* Professor Smith.

Individual Research Courses

121. Invertebrate Morphology and Parasitology. *One to two units.*
Professor Ward.

122. Vertebrate Morphology. *One to two units.* Professor Kingsley.

123. Faunistic and Systematic Zoology. *One to two units.*
Professor Smith.

124. Experimental Zoology. *One to two units.* Professor Zeleny.

125. Animal Ecology and Behavior. *One to two units.*
Assistant Professor SHELFORD.

127. THEORIES OF ANIMAL PHYLOGENY.—Relations of various groups of animals; signification of so-called intermediate forms; study of invertebrate larval forms and of theories of descent based on them. Lectures; assigned readings; demonstrations. *Once or twice a week; both semesters. One unit.*
Professor WARD.

[Given in 1915-16 and alternate years.]

Courses for Graduates and Advanced Undergraduates

3. MICROSCOPICAL TECHNIQUE AND GENERAL VERTEBRATE EMBRYOLOGY.—Theory and practice of microscopical technique. *Twice a week; first semester.*
Professor KINGSLEY.

6. VERTEBRATE ORGANOGENY.—Development of the organs of the vertebrate body. (A continuation of course 3.) *Three times a week; second semester.*
Professor KINGSLEY.

8a-8b. THESIS INVESTIGATION.—Individual work on assigned topics. *Both semesters.* Various Instructors.

11. EXPERIMENTAL ECOLOGY AND GEOGRAPHY.—The physiology of environmental relations, facts, principles, and methods of analysis of behavior. World and regional aspects of behavior and ecology including animal distribution as related to climate and vegetation. *Two or four times a week; first semester.*
Assistant Professor SHELFORD.

17. FIELD ZOOLOGY.—Collection, preservation, and identification of common representatives of lower vertebrates and of various groups of land and fresh-water invertebrates; identification work on living and preserved material; observations on the habits and life histories of selected forms. *Three times a week; first semester.* Professor SMITH.

18. ADVANCED FIELD ZOOLOGY.—More restricted problems in connection with the local fauna; taxonomic or distributional problems. (A continuation of course 17.) *Two to five times a week; second semester.* Professor SMITH.

20a-20b. CURRENT LITERATURE.—*Once a week; both semesters.*
Professor ZELENY.

21a-21b. INTRODUCTION TO ZOOLOGICAL RESEARCH.—Structure, life-history, or relations of invertebrate animals especially parasitic forms. Laboratory; conferences; assigned reading. *Two to five times a week; both semesters.*
Professor WARD.

22-23. MORPHOLOGY OF VERTEBRATES.—The skeleton and the brain, the cranial nerves, and the eye and ear. *Two to five times a week; both semesters.*
Professor KINGSLEY.

25-26. EXPERIMENTAL ZOOLOGY.—Experimental embryology; regeneration; heredity; variation; evolution. *Two to five times a week; both semesters.*
Professor ZELENY.

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UNIVERSITY OF ILLINOIS BULLETIN

ISSUED WEEKLY

Vol. XIV JULY 2, 1917 No. 44

[Entered as second-class matter December 11, 1912, at the post office at Urbana, Illinois, under the Act of August 24, 1912.]

THE GRADUATE SCHOOL

OF THE

UNIVERSITY OF ILLINOIS

1917-1918

PUBLISHED BY THE UNIVERSITY OF ILLINOIS
URBANA

THE UNIVERSITY OF ILLINOIS

THE STATE UNIVERSITY

THE UNIVERSITY INCLUDES

The Graduate School, which offers courses of graduate study in all departments of the University.
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THE GRADUATE SCHOOL

OF THE

UNIVERSITY OF ILLINOIS

Announcement for
1917-1918

PUBLISHED BY THE UNIVERSITY
URBANA, ILLINOIS

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THE UNIVERSITY CALENDAR

1917-1918

As Applicable to the Graduate School

FIRST SEMESTER, 1917–1918

1917	
Sept. 7, 8, Monday, Tuesday	Registration days
Sept. 19, Wednesday, 8 a. m.	Instruction begun
Nov. 5, Monday, 5 p. m.	Latest day for announcement of subjects for graduate theses
Nov. 29, Thursday	Thanksgiving Day
Dec. 3, Monday	Illinois Day
Dec. 21, Friday, 11 a. m.	Holiday recess begun
Dec. 31, Monday, 5 p. m.	Latest day for submission of outlines of theses by candidates for professional degrees in engineering
1918	
Jan. 3, Thursday, 1 p. m.	Instruction resumed
Jan. 24, Thursday	Semester examinations begun
Jan. 31, Thursday	Semester examinations ended

SECOND SEMESTER, 1917–1918

Feb. 4, 5, Monday, Tuesday	Registration days
Feb. 6, Wednesday, 8 a. m.	Instruction begun
Feb. 12, Tuesday	Lincoln Day
Mar. 28, Thursday	Easter recess begun
April 1, Monday, 5 p. m.	Latest day for filing of completed theses by candidates for professional degrees in engineering
April 2, Tuesday, 1 p. m.	Instruction resumed
May 18, Saturday, 12 m.	Latest day for receipt by the Dean of the Graduate School of certified copies of doctors' theses
May 31, Friday, 8 a. m.	Final examinations begun
June 1, Saturday, 12 m.	Latest day for receipt by the Dean of the Graduate School of certified copies of masters' theses
June 7, Friday	Final examinations ended
June 9, Sunday	Baccalaureate address
June 11, Tuesday	Alumni Day
June 12, Wednesday	Forty-seventh Annual Commencement

THE EXECUTIVE FACULTY

EDMUND JANES JAMES, PH.D., LL.D., PRESIDENT OF THE UNIVERSITY

DAVID KINLEY, PH.D., LL.D., *Professor of Economics and Dean*

ALBERT PRUDEN CARMAN, A.M., D.SC., *Professor of Physics*

JULIUS GOEBEL, PH.D., *Professor of Germanic Languages*

GEORGE ALFRED GOODENOUGH, M.E., *Professor of Thermodynamics*

HARRY ALEXIS HARDING, PH.D., *Professor of Dairy Bacteriology*

LAURENCE MARCELLUS LARSON, PH.D., *Professor of History*

HERBERT WINDSOR MUMFORD, B.S., *Professor of Animal Husbandry*

WILLIAM ABBOTT OLDFATHER, PH.D., *Professor of Classics*

STUART PRATT SHERMAN, PH.D., *Professor of English*

ARTHUR NEWELL TALBOT, C.E., *Professor of Municipal and Sanitary Engineering*

EDGAR JEROME TOWNSEND, PH.D., LL.D, *Professor of Mathematics*

HENRY BALDWIN WARD, PH.D., *Professor of Zoology*

CHARLES MAXWELL MCCONN, A.M., *Registrar, Secretary of the Faculty*

HISTORY AND ORGANIZATION

The University of Illinois offered facilities for advanced study and research in various lines as early as 1872. Organized graduate instruction, however, under the name of the Graduate School, was first undertaken in 1892. In 1894 the administration of the school was vested in the Council of Administration, and the Vice-President of the University became Dean of the School. In 1906 the Graduate School was organized as a separate faculty, consisting of a dean and members of the University faculty assigned to this duty by the President.

By action of the Trustees the teaching faculty of the Graduate School includes all members of the University faculty who give instruction in approved graduate courses. The affairs of the School, however, are in charge of the Executive Faculty appointed each year by the President.

ADMISSION

Admission to the Graduate School may be granted to graduates of institutions whose requirements for the bachelor's degree are substantially equivalent to those of the University of Illinois, and to applicants from other institutions approved by the Executive Faculty, as hereinafter provided. *Admission to the Graduate School does not, however, imply admission to candidacy for an advanced degree, and gives no right or claim to be so admitted. Such candidacy is determined by the Faculty after the student has demonstrated by his work here, for from two to five months, that he has the ability to do major work of graduate character. A mere accumulation of "credits" or "grades" is not sufficient.*

A graduate of an institution meeting the requirements of a standard college, as described below, may be admitted to the Graduate School, provided he satisfies the Dean and the departments concerned that he will be able to proceed to the master's degree in a period not exceeding two years.

For purposes of admission to the Graduate School a *standard college* is one which meets the following requirements:

1. An enrollment of not fewer than one hundred students of college grade, with an average for a series of years of at least twenty-five percent registered in the junior and senior classes.

2. A graduation requirement of four years (120 semester hours) of collegiate grade.

3. A minimum entrance requirement of 14 units. By the minimum requirement is meant the smallest number of units with which a student may be permitted to begin college work, i. e., the nominal requirement minus the number of units of conditions allowed.

4. A requirement that all entrance conditions must be removed before a student may be permitted to begin a second year of work in the same institution.

5. Not less than eight distinct departments in liberal arts and sciences, with at least one professor giving full time to college work in each department.

6. A minimum educational attainment of all college teachers of academic subjects equivalent to graduation from a college of high grade and graduate work equal to that required for the master's degree at the University of Illinois.

7. A maximum of 16 semester hours per week required of college teachers.

8. A maximum enrollment of 30 students in recitation or laboratory sections.

9. Buildings and equipment of the value of at least $100,000.

10. A productive endowment sufficient to yield a net annual income of at least $10,000 available for instructional purposes in the college department (liberal arts and sciences). If the institution offers courses in addition to the usual liberal arts course, it shall have a correspondingly larger income.

11. A library of not less than 10,000 bound volumes in addition to public documents.

12. Laboratory equipment of a value of not less than $3,000 in physics ($4,000 if work is offered in advance of one year-course), $2,500 in chemistry, and $2,500 in biology.

13. In addition to the foregoing specific requirements, the general standard of the administration and faculty shall be considered.

Admission to graduate courses may be granted only to those who have had the requisite undergraduate work in those courses or departments. But a student of mature age who satisfies the Dean and the department concerned of his ability to pursue graduate work in a given line may be enrolled in particular graduate courses, without reference to a degree, and permitted to carry on such study or investigation under the direction of a department of the University as the department shall recommend and the Dean approve.

Application blanks for admission may be secured from the Registrar of the University. Every applicant must submit with his application for admission an official transcript of his college record.

CHARACTER OF GRADUATE WORK

The principal aim of graduate study is the development of the power of independent work and the promotion of the spirit of research. Each candidate for a degree is expected to have a wide knowledge of his subject and of related fields of work; for the graduate student is not expected to get from lecture and laboratory courses all the knowledge and training necessary to meet the requirements for his degree.

Students, especially candidates for the doctor's degree, are warned against restricting themselves to the courses prescribed or suggested by the departments in which they are studying. Each student is expected to do a wide range of private reading and study, and in many cases will find it advisable to take one or more courses of lectures quite outside the field of his chosen subject.

REGISTRATION AND PROGRAM OF STUDY

The following regulations concerning registration and program of studies are laid out primarily for first-year students. Second-year and third-year graduate students fill out their programs irrespective of the unit value of courses, according to their needs, under the advice of their instructors.

Registration.—Each graduate student must register when he first connects himself with the University, and afterwards at the beginning of each semester.

The registration of a new student may be accepted at any time provided the student is prepared to take up courses actually under way. Credit towards the

fulfillment of the residence requirement dates, however, from the time of registration and not from the beginning of the semester or year in which the student enters. Registration will not be permitted later in the year than April 1, except in the case of students who expect to continue through the summer session, or are returning to complete a year's work which has been broken into by illness or other unavoidable interruption.

The first registration, or that upon entrance, is permitted only after the student's application for admission to the Graduate School, setting forth his educational attainments, has been duly approved.

A new student must fill out in duplicate an application for admission and submit it to the Registrar, from whom he will receive a card of admission and a study-list. He should fill out the study-list after consultation with his adviser, or the person in charge of his major work, and also with the instructors whose courses he wishes to elect. *In all cases, registration must be completed within two weeks.* Otherwise it is subject to a fee of one dollar.

Changes in Study-Lists.—A graduate student is expected to plan his work so carefully that changes in his study-list during the semester will not be necessary. When a change seems advisable, however, it may be permitted without fee if made within three weeks of the date of registration. After that date a fee of one dollar is charged for each change, except that the total charge for a rearrangement authorized on any one change slip shall not exceed two dollars.

Advisers.—The person in charge of the major work of the student becomes his adviser, and, together with those with whom the student is taking first and second minor courses, forms a committee with general supervision over the student's general course of study. This committee is expected to follow the student's work and see that he is helped to lay out an intelligently planned course, and to give him such advice as may be necessary concerning his scholastic career.

Amount of Work.—Each student is required to attend a minimum of four class, lecture, or laboratory exercises a week in the first year of his graduate study; in no case is he permitted during his course to attend more than twelve a week.

Each first-year student doing full work must take at least four unit courses, and may be required to take five, or their equivalent. A unit course is one which requires ten hours of time a week through one semester, irrespective of the mode of distribution of that time in class work, laboratory work, and private study. Four such courses or their equivalent constitute a full *minimum* program for one semester, and eight such courses, or their equivalent, of graduate grade, constitute the *minimum formal* year's work required for a master's degree. Five and ten are the maximum for one semester and the year respectively.

Unless otherwise specially permitted, every student must take each semester at least one course open to graduate students only (courses numbered 100 and upwards).

Undergraduate Courses Open to Graduate Students.—Courses to which sophomores are regularly admitted may not be taken for graduate credit, either major or minor.

Unless otherwise specified on the student's program by the department concerned, a course for graduates and advanced undergraduates, not open to students below senior grade and counting four or five hours of undergraduate credit, if taken by graduate students, will be treated as a unit course; when counting less than four

hours of undergraduate credit, such a course, if taken by graduate students, will be treated as a half-unit course.

Unless otherwise specified on the student's program by the department concerned, a course the prerequisites of which are such as to make it possible for juniors to be admitted, if taken by a graduate student, is counted as a half-unit course or a quarter-unit course, according to the number of hours of undergraduate credit for which the course is given.

Transfer of Undergraduate Credit.—No credit earned during the undergraduate course may be transferred for graduate credit, unless such credit was earned in time additional to the time normally required for the bachelor's degree, in the second semester of senior year, and then only for minor subjects, and on petition.

If at the end of the first semester of his senior year a student has so far completed his work for the bachelor's degree that his program for the second semester is not full, he may elect one or more graduate courses. But such election must be in accordance with Graduate School rules and must be approved by the Dean.

Failures.—A graduate student who fails in his major subject cannot acquire his degree in the same year in which the failure occurred. No condition examinations are given graduate students.

Miscellaneous and Listeners' Courses.—Graduate students are permitted under proper circumstances to attend classes as listeners, and to elect miscellaneous subjects, that is, courses which do not count towards an advanced degree. Listeners' cards may be obtained at the Dean's office. Under the authority conferred by the faculty on the Dean no student with a full minimum program will be permitted by the Dean to visit more than one class or to take more than one miscellaneous subject, nor is any subject open as a listener's or miscellaneous course unless it has a specific educational bearing on the student's major or minor subjects of study.

A student who elects a miscellaneous course is required to register in it, do the work, and pass the semester examinations unless he is permitted to withdraw under the rules. A student who has a listener's card is not permitted to participate in the classwork or the examination.

No student may register for a full minimum program of work for graduate credit if it is necessary for him to carry at the same time more than one miscellaneous subject and to visit one course.

Students on the Staff.—Assistants and others on the University staff who undertake to do graduate work are permitted to take an amount of work determined by the terms of their employment. Such a student, applicant for a master's degree, must ordinarily stay through at least two years. In no case will the doctor's degree be conferred upon an applicant otherwise fit in less than four years if he is on the staff in any capacity. The exact amount of time required depends on the duties of his position.

The enrollment of a member of the staff is subject to the approval of the officer to whom he is responsible as a member of the staff and of the Dean of the Graduate School with reference to the amount of work to be taken. Before credit may be recorded for such graduate student at the end of a semester, the head of the department in which he is employed, or some one authorized by the head, must certify

that the time given to graduate work by the student has not impaired the work for which he is paid by the University.

Residence and Work Done Elsewhere.—Continuous residence and study are required of all members of the Graduate School, unless they are granted leave of absence by the Dean, upon recommendation of the professor in charge of their work, for the purpose of carrying on elsewhere studies or investigation in the line of work for their degrees.

The term "full year's work in residence" means work which requires all the student's working time through two semesters.

Students should note that all the work for the master's degree must be done in residence at the University, excepting in the case of members of the staff who have spent half of their time in study through a year at some other institution, and then do the rest of the work required during a year in residence here. Credit for work done elsewhere is not "transferred." The candidate is examined here on all the work required for the degree.

Withdrawal.—If after registration a graduate student wishes to withdraw from any course or to add other work, or if he wishes to withdraw altogether from the University, he should first secure the necessary papers from the Dean's office. See the regulations concerning changes in study lists, page 11.

DEGREES

The Master's Degrees.—The master's degree conferred depends upon the character of the bachelor's degree. The usual practise is that A.M. shall follow A.B., that M.S. shall follow B.S. However, this practise may be departed from in cases where the undergraduate course of study of the candidate was of a kind for which some reputable institutions in this country give A.B., while others give B.S. Such departure from the regular practise is permitted, however, only on individual petition duly approved.

Amount of Work Required.—Candidates for the degree of Master of Arts or Master of Science are required to do at least one full year's work in residence, including a thesis. By one year's work for the master's degree is meant from four to five unit courses each semester, or their equivalent. Whether a student is required to take more than four units a semester depends on the character of his work in college and in the first semester of his graduate course, but the completion of the required number of units is not of itself sufficient to insure the student's receiving his degree. A failure in any subject or an absence from examination in any subject may prevent the conferring of his degree; and, as already indicated, failure in any course in the major field precludes the conferring of the degree in that year. At least two units in courses numbered 100 and upwards are required.

Majors and Minors.—A candidate for a master's degree may do all his work in one subject, or he may select a major and one minor, or a major and two minors. A major or minor denotes the field of knowledge of a department, or such part thereof as constitutes a separate and independent division of that field. For a master's degree a major is at least half the work, or a minimum of four units, for one year. Less than one unit may not be counted as satisfying the requirements

of a minor for a master's degree without the approval of the student's adviser and of the department concerned.

A program of studies for a first-year graduate student which is limited exclusively to the investigation of a single problem will not be approved.

Foreign Languages.—The ability to use one or more of the modern languages ordinarily studied in the undergraduate curriculum is expected of all candidates for the master's degree, and in some lines of study is required. On this matter students should consult the head of the department in which their major subjects lie.

Master's Thesis.—Each candidate for a master's degree is required to present a thesis on some subject approved by the professor in charge of his major work and the Executive Faculty of the Graduate School. The requirement of a thesis may be waived, however, upon the recommendation of the head of the department in which the student is doing his major work, and with the approval of the Dean, provided application to waive the thesis is made at the beginning of the year. *In no case will permission to take the degree without the thesis be given by the Dean if applied for later than the latest date for the approval of thesis subjects, as shown by the calendar.* A student excused from writing a thesis must replace it with additional courses of instruction.

No one will be excused from writing a thesis unless one-half of his program of studies consists of courses numbered 100 and upwards.

The thesis required from a candidate for a master's degree ordinarily will demand one-fourth of the student's time and may not exceed one-third of it. The thesis must be typewritten, on "thesis paper," and the title-page must be printed. The thesis in its final form, together with a certificate of approval by the proper officer, must be left by the professor in charge at the Dean's office at the time set in the calendar. No article prepared for another use, or previously published, will be accepted as a thesis.

Graduate Study in the Summer.—Attendance on four summer sessions of nine weeks each, or one semester and two summer sessions of nine weeks each, is considered the equivalent of one year in residence. If in these sessions the required amount of work is properly done a master's degree may be earned in this way. The faculty is unwilling to accept summer-session work beyond the master's degree towards the doctor's degree, except in the case of a student who works in a summer session preceding or following a regular year's attendance at the University. In no case may the last year's work for the doctorate be done in disconnected summer sessions.

No course offered in the summer session may be taken for credit towards a higher degree unless it is specially described in the summer-session circular as accepted for that purpose.

Graduate students in the regular summer-session period are credited with only 8 weeks towards the fulfillment of the time requirement for the master's degree. It is necessary, therefore, for those who take work through four summer sessions for this degree to complete the residence requirement of thirty-six weeks by taking four additional weeks. This may be done at any summer session by continuing work after the close of the regular session, under the direction of the instructor with whom

the student is working. The student is examined on the work thus done as on all other work, and must report his additional work to the Dean.

Graduate courses in medical science are offered in the summer quarter between June and September at the College of Medicine of the University of Illinois in Chicago. Circulars describing the courses offered and conditions of admission and work may be obtained from the Secretary of the College of Medicine, Congress and Honore Streets, Chicago.

Marine Biological Laboratories.—Students in zoology, candidates for the master's degree, part of whose necessary preparation is experience in a marine or fresh-water biological laboratory or station, are permitted to offer, in part fulfillment of the requirements for the master's degree, work done in such fresh-water or marine laboratory; provided that the student who wishes to have such work accepted make application before beginning work in such laboratory; that the selection of the laboratory at which he is to work has been approved by the faculty beforehand; that the time to be spent in such work be not less than six nor more than nine weeks in any one summer; that the instructors under whom the student is to work have been previously accepted by this faculty; that he submit to an examination here on the work done at such laboratory; and that a certificate of attendance from a proper officer of the laboratory or station be submitted and a full written report of the work done in the shape of notes, or otherwise, be required; and that the student shall be in residence here at the University for one full academic year during which he shall do the rest of the work necessary for his degree.

The marine biological laboratories which have thus far been approved as institutions at which students of this University may take work for record here are:

Marine Stations:

Marine Biological Laboratory, Woods Hole, Massachusetts
Harpswell Marine Laboratory, Casco Bay, Maine
Puget Sound Station, Friday Harbor, Washington
Hopkins Marine Laboratory of Stanford University, Pacific Grove, California
Scripps Institute for Biological Research, University of California, LaJolla, California
Carnegie Institution Laboratory, Dry Tortugas, Florida
Bermuda Biological Station, Bermuda

Fresh-Water Stations:

Douglas Lake Station, University of Michigan, Topinadee, Michigan
Ohio State University Laboratory, Cedar Point, Ohio
University of Wisconsin Lake Laboratory, Madison, Wisconsin

Masters' Degrees in Engineering

Two classes of second degrees are open to graduates of the College of Engineering, namely, academic and professional.

The academic second degree in engineering is Master of Science, following Bachelor of Science, in architecture, architectural engineering, civil engineering, electrical engineering, etc. This degree is conferred in accordance with the regulations described above for *academic work in residence only.*

The *professional* second degrees in engineering are as follows:

Master of Architecture, after B.S. in architecture.

Architectural Engineer, after B.S. in architectural engineering.

Civil Engineer, after B.S. in civil engineering or B.S. in municipal and sanitary engineering.

Electrical Engineer, after B.S. in electrical engineering.

Mechanical Engineer, after B.S. in mechanical engineering.

Engineer of Mines, Civil Engineer, Electrical Engineer, or Mechanical Engineer, after B.S. in mining or railway engineering, according to the course.

Professional degrees are conferred on two classes of candidates: (1) graduates of the College of Engineering of the University of Illinois who have been engaged in acceptable professional work away from the University for a period of not less than three years after receiving the degree of Bachelor of Science; (2) graduates of the University of Illinois, or of institutions of equal standing, who have been engaged in acceptable professional work in residence at the University for a period of not less than three years after receiving the degree of Bachelor of Science.

In "acceptable professional work" may be included contributions to technical literature, activity in professional societies, investigation of engineering problems, and the teaching of engineering subjects.

A candidate must declare his candidacy and file with the Dean of the College of Engineering, as chairman of the committee in charge, a detailed statement covering his professional study and experience, not later than the first Monday in November preceding the commencement at which he proposes to qualify. Prior to December 31 next succeeding, he must submit for approval an outline of his proposed thesis and he must file his completed thesis not later than April 1. If the statement of professional experience and study and the thesis are accepted, the candidate must present himself at commencement in order to receive the degree.

Candidates for professional engineering degrees who already hold the degree of Master of Science may qualify for the professional degree after two years of professional work.

A candidate for a professional engineering degree must pay the incidental fee of thirty dollars on being notified that his professional study and experience are accepted as qualifying him to enter as a candidate for the degree. No one will be enrolled as a candidate for the degree at the following commencement who does not pay his fee at this time. When a candidate for a professional engineering degree has once been accepted and paid his fee, he is eligible to receive the degree at any time within five years, without additional fee, on completion of the requirements; provided, however, that unless he completes the requirements within two years his name will be dropped from the list of candidates and in order to receive the degree within the five-year period he must register once more.

The Degree of Doctor of Philosophy

The requirements for the degree of Doctor of Philosophy are a thoro mastery of a selected field of study, evidence of the power of independent investigation in this field, a broad knowledge of the wider field of study of which this major subject is a part, a general acquaintance with related fields of knowledge, and a mastery of all branches of study which are necessary to a full knowledge of the main subject. Each student who is seeking this degree is expected to choose for study and final

examination a major subject, or field of study, and a first and second minor. The major subject is the field in which the student expects to become expert and an authority. The first minor must be a subject closely related to the major and may, under certain conditions and with proper approval, be a subdivision of the major field of study. The second minor should be chosen outside of the major field of study.

When a candidate chooses any subject as his major and a division of that subject as his minor, he is not permitted to choose as a second minor any division of work in that same department, except by vote of the Executive Faculty of the Graduate School.

For the doctor's degree no definite division of a student's time among major and minors can be made, to hold in all cases. In general the faculty approves an arrangement which, distributing the student's time through the required three years, divides it equally among his three subjects in his first year of graduate study; and in the proportion of two to one, as between his major and first minor, in the second year of graduate study (his second minor being finished and dropped at the end of the first year); and gives all his time to his major during his third year.

To put the matter in another way, a course of graduate grade (from among the "hundred" courses) meeting twice or three times a week, corresponding roughly to what is sometimes called a full course, or in our terminology a unit course, running through the year, should ordinarily be sufficient for a second minor; a similar course running through two years should ordinarily be sufficient for a first minor.

While "full-time work" in the first year of graduate study, leading usually to a master's degree, is at least eight units for the two semesters, full-time work after the first year is not reckoned in units. The student is simply required to devote all his time to his work. Nor is there any necessary correspondence between the number of courses taken and the number of units required in the first year or full-time work in any year. A first-year student might possibly secure all the credit necessary in two or three courses; and a second-year or third-year student might conceivably be devoting all his time to one course and his research or to his research alone.

The candidate's list of subjects must receive the approval of the head of the department in which he chooses his major work and of the Dean of the Graduate School.

Period of Study.—The *minimum* period of study required for securing the degree of Doctor of Philosophy is three years, during which the student is required to devote all his working time to his studies. The degree is conferred, however, not for residence during a certain period, but for scholarly attainments and power of investigation, as proved by thesis and examinations.

At least the first two or the last one of the three years required must be spent at this University.

Credit for work done in other universities is not "transferred." The candidate is examined here on the subjects offered by him for the advanced degree. However, his period of residence at another institution of proper grade may be accepted in fulfillment of the residence requirement of the University of Illinois, so far as it goes.

Preliminary Examination.—Towards the end of his second year of study, or, by special permission, at the beginning of his third year, the candidate for the degree must submit to a preliminary examination conducted by the members of the faculty with whom he is doing his principal work, in order to determine whether he will be accepted as a candidate for the degree in the following year. This exam-

ination is intended to test the student's knowledge of the fields of his major and minor subjects of study. It is partly oral, and may be wholly so.

Language Examination.—The candidate will be required to demonstrate his ability to read French and German and other languages needed for the prosecution of his work.

The examination in French and German is in charge of a committee of three, consisting of the head of the department in which the student is taking his major work, a member of the department of modern languages, and a member appointed by the Dean of the Graduate School; this test of proficiency in the use of French and German takes place at the time of the preliminary examination for admission to candidacy for the doctor's degree.

Final Examination.—On or before the last Monday in May of the year in which the candidate expects to come up for his degree, he must submit to a final examination. Besides the written examination set by the departments of the major and minor studies, the candidate must also take an oral examination, given by a committee appointed by the Dean. The oral examination is primarily on the research work of the student, as embodied in his thesis, but it is not confined to this. It extends to the whole field of the study of the candidate. It will not be confined to the courses which the candidate has attended in the University of Illinois only, if he has done part of the work elsewhere; nor even to the field covered by the courses specifically taken in this or other universities; but will be so conducted as to determine whether the candidate has a satisfactory grasp of his major subject as a whole, and a general acquaintance with the fields of knowledge represented by his course of study.

Before the candidate is admitted to the final examination and the defense of his thesis, he may be required to take any other examination, oral or written, that is thought proper by the various departments in which he has studied. If, after having passed his preliminary examination, he fails in the third year of his study to meet the expectations of the professors in charge of his work, or in any way fails to maintain the standard of scholarship and power of research expected of him, he may be refused admission to the final examination.

The final examination in the major and minor subjects may not be divided. The examination must be taken all at one time even tho it requires several sessions.

The above examinations are in addition to those in the courses for which the student is registered. These must be taken at the times for which they are set in the examination schedule.

Thesis.—The power of independent research must be shown by the production of a thesis on some topic connected with the major subject of study. The candidate is expected to defend his thesis or dissertation before the members of the faculty, or as many of them as may wish to question him about it, in connection with his final examination.

The subject of the thesis should be chosen not later than the end of the second year of study and must be submitted for formal approval by the faculty not later than the first Monday of November of the year when the degree is expected. Unless previously printed with proper authority, a typewritten copy of the complete

thesis, *on thesis paper**, must be in the hands of the Dean not later than noon of the Saturday nearest the middle of May, for submission to the examining committee.

The doctor's thesis must be printed and one hundred copies deposited in the Library of the University by the candidate, not later than the first of June preceding the conferring of the degree. In form, the printed thesis must follow the "instructions for the preparation of masters' and doctors' theses," copies of which may be obtained at the Dean's office on application. If it is not printed by the first of June, the student must, not later than that date, deposit seventy-five dollars ($75) or a bond for that amount satisfactory to the Comptroller of the University and the Dean of the Graduate School. A member of the faculty of the University of Illinois will not be accepted as a guarantor on such a bond. If a bond is accepted, it must be replaced at the end of one year with a cash deposit. At the end of two years, if the thesis has not then been printed by the student, the University will print such part of it as it deems best.

The cash deposit made by the student who does not print his thesis by the end of the second year after his degree is conferred becomes the property of the University, to be used for the general purpose of printing theses.

The title-page of each thesis, whether typewritten or printed, must bear the words, "Submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in—[here put the major subject]—in the Graduate School of the University of Illinois." The title-page must also contain the full name of the author, his previous degrees, the full title of the thesis, the year of imprint and, if a reprint, the title and volume and a statement of the pagination of the volume from which it is reprinted. Each thesis must have an appendix giving a short biography of the candidate, including the institutions he has attended, his degrees and honors, the titles of his publications, and such other matters as are pertinent.

Doctor's Degree in Engineering.—The degree of Doctor of Philosophy in Engineering is offered in certain lines of academic graduate work of a high scholastic type in engineering science that will attract students who wish to prepare themselves as teachers, investigators, and experts.

The general requirements for this degree, as to preliminary education, linguistic attainments, etc., are the same as in other lines.

The following lines of engineering science are open as majors:

Engineering mechanics
Hydraulic and sanitary engineering
Steam engineering
Electrical engineering
Heating and ventilation engineering
Railway engineering
Masonry construction and structural engineering
Coal-mining engineering

The first minor may be any of the above or one of the following fundamental sciences or an authorized combination of two of them:

Theoretical mechanics
Mathematics

*No other will be accepted by the Dean.

Thermodynamics
Chemistry
Geology
Physics (Experimental or mathematical)
Zoology
Botany

The second minor should be in other than engineering subjects.

SCHOLARSHIPS AND FELLOWSHIPS

A number of scholarships and fellowships have been established by the Trustees of the University. To first-year graduate students of ability and promise there are open a number of scholarships with a stipend of $250 each and freedom from tuition, incidental, and laboratory fees. To second-year and third-year graduate students, that is, those who have had one or two years of graduate study, there are open fellowships with a stipend varying from $300 to $500, with freedom from the above-mentioned fees. The larger stipends are given only to students who are expected to take their degrees within the year. Each holder of a fellowship or scholarship must pay the matriculation fee of ten dollars, unless he holds a first degree from the University of Illinois, and also the diploma fee of five dollars on receiving his diploma.

Candidates for these scholarships and fellowships must be graduates of the University of Illinois, or of colleges or universities having equivalent requirements for bachelors' degrees.

Application must be made on blanks to be obtained from the Dean of the Graduate School. These application forms should be sent to the Dean of the Graduate School as early as possible in February of the academic year preceding that for which the fellowship is desired. No application will be considered if received later than March first, until after April fifteenth, the date when appointees from the first list of applicants must accept or refuse their appointments.

Persons appointed are notified on April first and must send the Secretary of the Board of Trustees notice of their acceptance or refusal by April fifteenth; and must agree that, if accepted, the appointment will not be resigned to take a similar one in any other institution during the year for which it is awarded.

Nominations to fellowships are made on the grounds of worthiness of character, scholastic attainments, and promise of success in the principal line of study or research to which the candidate proposes to devote himself. Scholarships and fellowships are not given to candidates who are over thirty years of age at the time when the appointment is to be made.

For second-year fellowships, adequate preparation in one foreign language, and for third-year fellowships, adequate preparation in both foreign languages, is required.

Scholarships and fellowships are good for one year, but may be renewed for a second or a third year in special cases. An appointment as honorary fellow, without stipend, may be made as specified for paid fellowships in the case of any one who has shown distinguished merit in his work.

Research Fellowships in the Engineering Experiment Station

The Engineering Experiment Station is devoted entirely to research. Its purposes are the study of problems of special importance to engineers and to manufacturing, railway, mining, and industrial interests, and the stimulation and elevation of engineering education.

Fourteen research fellowships have been established in the Engineering Experiment Station. These Fellowships are open to graduates of approved technical schools and universities. There is a stipend of $500 a year for each fellowship. Applicants to whom these fellowships are awarded are required to agree to hold them for two years, devoting a part of their time to the work of the Engineering Experiment Station. At the expiration of this period, if all requirements have been met, the degree of Master of Science will be conferred.

Applications for these fellowships should be made to the Director of the Engineering Experiment Station not later than February first. Candidates must present with their applications full information concerning themselves, including any written or published papers or results of investigation.

LIBRARIES

The general University library, the library of the State Laboratory of Natural History, and that of the College of Law are all at the University in Urbana. The libraries of the School of Pharmacy and the Colleges of Dentistry and Medicine are in Chicago.

The University libraries contain 397,967 cataloged volumes, about 13,000 uncataloged, and 102,029 pamphlets. Of these, 389,321 books and 97,834 pamphlets are in the libraries at Urbana; the rest are in Chicago. The library at Urbana also contains 3,180 maps and 4,123 pieces of sheet music. The departments at Urbana currently receive 5,268 periodicals, while the College of Medicine and School of Pharmacy in Chicago receive 244 more.

The general library of the University is open daily, from 8 a. m. until 10 p. m. and on Sunday from 2 p. m. to 6 p. m.

The Mason Historical Library.—The library of western history collected by Edward G. Mason, Esq., long President of the Chicago Historical Society, is in the Public Library of the city of Champaign, and is accessible to University students.

The Dittenberger Classical Library.—The University possesses the library of Wilhelm Dittenberger, at one time Professor of Classical Philology in the University of Halle. This library contains 5,600 items. It includes the works of the poets and prose writers, numerous works on grammar and history of literature, and between four and five thousand dissertations and programs on special topics. There are also many works dealing with other departments of classical philology, as epigraphy, history of ancient peoples, archeology, philosophy, history of art, geography, chronology, metrics, etc.

The Heyne Library of Germanics.—The entire library of Professor Moritz Heyne of the University of Göttingen was bought by the University. It contains about 5,200 volumes. The collection is rich in the general field of German philology and especially in lexicography. It has many rare first editions of works of German literature from the sixteenth, seventeenth, and eighteenth centuries and has sets

of a number of rare periodicals. It is also rich in works on the history of German civilization.

The Gröber Library in Romance Languages.—The University also possesses the library of Professor Gröber of the University of Strassburg. This library contains about 6,500 titles, and, added to what is already in the University library, furnishes somewhat over 10,000 volumes for this field.

The Vahlen Library, the property of the late Johannes Vahlen, Professor of Classical Philology at the University of Berlin, contains about 10,000 volumes and is in itself an excellent working library in classical philological literature. Being especially well supplied with texts of Greek and Latin authors, it supplements the Dittenberger collection.

The Aron Library, collected by the late teacher and student of pedagogy, R. Aron, contains about 20,000 volumes. It is a scholarly collection of educational documents, among them many original and early editions, and furnishes firsthand material for the study of educational movements in Europe, especially in Germany, from the time of Luther and Comenius to the present. The collection of German "Fibeln" or school readers is unique, and the material for the history of juvenile songs and literature, the set of 17th and 18th century atlases, and the collection of rare hymn books and juvenilia make the collection very useful to students of education.

FEES AND EXPENSES

Except as noted below, graduate students pay fees as follows:

Matriculation fee	$10.00
Incidental fee, each semester	15.00
Diploma fee	5.00
For late registration	1.00
For changes in study-lists	1.00

All graduate students who have not matriculated as undergraduates at the University of Illinois pay the matriculation fee on entrance.

All graduate students pay the diploma fee on being recommended for their degrees.

No tuition or incidental fee is charged for graduate courses to scholars, fellows, or members of the corps of instruction or the staffs of the scientific bureaus or experiment stations who are appointed by the Board of Trustees, nor for undergraduate courses on their study-lists if approved by the heads of the departments and by the Dean of the School as necessary or desirable for the proper completion of the work for the degree. Otherwise graduate students who take undergraduate courses must pay the proper undergraduate fee.

Each student working in the laboratories, or in the drafting or engineering classes, is required to make a deposit of from 50 cents to $10.00, to pay for chemicals and apparatus used, and for any breakage or damages. But no charges or deposits for laboratory materials are required from scholars, fellows, or members of the corps of instruction or scientific staffs mentioned above.

Table board may be obtained at prices ranging from $4.50 a week.

Room rent, with two in a room, ranges from $2.50 a week.

THE GRADUATE CLUB

The Graduate Club is an unofficial organization of the graduate students and faculty. Its purpose is to furnish an opportunity for those working in different departments to become acquainted with one another and thus counteract the tendency toward narrowness which intense specialization may sometimes induce.

DEPARTMENTS OF INSTRUCTION

Courses open to graduate students are of two classes. The first class is wholly of graduate grade, and the courses are numbered 100 upwards. The second class includes the courses classified as for graduates and advanced undergraduates. These carry numbers below 100. The courses numbered 100 and upwards are all accepted for major credit. Those of the other group are in many cases accepted only for minor credit. This is especially true of courses which are open to juniors.

All courses have certain prerequisites for admission. Inasmuch as this prerequisite preparation may be gained at different institutions from courses differing from those offering a similar preparation at the University of Illinois, so that a statement of prerequisites as given here would not be understood elsewhere, their description is omitted altogether. However, a student who wishes to enter a particular course must satisfy the department concerned that he has had in some form the prerequisites for admission to the course.

No course the prerequisites of which are such as to admit students below junior grade (60 semester hours of credit) will be accepted for credit towards a master's or doctor's degree, except by vote of the Executive Faculty of the Graduate School in special subjects and for special reasons.

For the convenience of first-year students the credit value of graduate courses is given in units. These values have no significance for second-year and third-year students.

The credit received for "courses for graduates and advanced undergraduates" is in accordance with the regulations of the Graduate School circular, pages 13 and 14.

No course may be listed for graduate credit among the courses for graduates and advanced undergraduates if it is conducted by a member of the staff who is himself registered as a graduate student in the same line of work.

Students are admitted to graduate standing in agriculture who have had a thoro training in the sciences underlying agriculture, and who are otherwise eligible to the Graduate School, even tho their undergraduate course of study lacked to some extent the amount and kind of technical work in agriculture included in the course of study for the bachelor's degree in agriculture at the University of Illinois.

ACCOUNTANCY

These courses may be taken for second minor credit only. They may be chosen only by students who have had at least two years' previous training in accountancy and whose major subject is economics (including commerce), business organization, railway administration, engineering, or agriculture.

Courses for Graduates and Advanced Undergraduates

3a–3b. Accounting Problems and Auditing.—Must be taken throughout the year in order to secure credit. *Three times a week; both semesters.*

Mr. Scovill

4a–4b. Cost Accounting.—(a) Cost accounting applied to factory procedure, overhead expense, the installation and control of cost systems, presenta-

tion of cost data; (b) as a basis for manufacturing efficiency; (c) the construction of cost systems. *Twice a week; both semesters.* Mr. Scovill

13a–13b. Municipal and Institutional Accounting.—*Twice a week; both semesters.* Mr. Morey

AGRONOMY

Students taking their major work in agronomy must have had the major courses in agronomy offered to undergraduates in the College of Agriculture of the University of Illinois, or their equivalent. Graduate students may specialize either in soils or in crops. Courses 7, 11, and 12, or the equivalent, will be required of graduates who specialize in soils and courses 7, 12, and 22, or the equivalent will be required of those specializing in crops. While everyone seeking a doctor's degree with agronomy as a major will be required to have a general knowledge of the whole field of agronomy, each student is expected to prepare a thesis in some one of the divisions, soil fertility, soil physics, soil biology, plant breeding, or crop production.

Students who are taking their major work in other departments and choose agronomy as a minor, must have had previously the work in chemistry, botany, and other fundamental sciences prescribed for the undergraduate courses in agronomy in the College of Agriculture, or the equivalent.

Courses for Graduates

101. Soil Investigations.—System of soil investigations; sources of error and methods of control; interpretation of results. *Twice a week; both semesters. One unit.* Associate Professor Stewart

104. Seminar in Agronomy.—*Once a week; both semesters. Half unit.* Dr. Whiting and others

112. Plant Breeding.—Experiments at this station; methods and results reported from other states and from foreign countries. *Twice a week; both semesters. One-half to two units.* Professor Smith

114. Crop Production.—Crop ecology; methods and results of crop production investigations. *Once a week; both semesters. One-half to two units.* Associate Professor Burlison

118. Investigations.—A special problem is chosen by each student. *Consultation one to five times a week for different students; both semesters. One to four units.* Professors Hopkins, Smith, Mosier
Associate Professors Stewart and Burlison, Dr. Whiting, Dr. Gernert

Courses for Graduates and Advanced Undergraduates

7. Advanced Farm Crops.—Climatic and soil factors; rotation; distribution of labor; cost of production; pure seed production; supply and consumption of products and by-products; storage and marketing. *Three times a week; second semester.* Associate Professor Burlison

11. Soil Biology.—Biochemical activities of soil microorganisms in relation to soil fertility. *Five times a week; second semester.* Dr. Whiting

12a. Soil Fertility, Fertilizers, Rotations.—The influence of fertility; effect of different crops on the soil and on succeeding crops. *Twice a week; second semester.* Professor Hopkins

22. Plant Breeding.—Improvement of field crops; selection. *Twice a week; second semester.* Professor Smith

23. Plant Food Supplies.—The world's supply of plant food materials; utilization and conservation. *Twice a week; second semester.*
Associate Professor Stewart

ANIMAL HUSBANDRY

Students entering graduate work in animal husbandry must have a thoro training in the fundamental principles of the subject either in connection with or in addition to a course of study in agriculture substantially equivalent to that offered in this University.

Courses for Graduates

103. Live Stock Experimentation.—Objects, methods, and the sources of error in experimental work dealing with the feeding, breeding, and management of farm animals. *Once a week; both semesters. One-half unit.*
Professor Davenport

110. Animal Nutrition.—Biochemistry, digestion, metabolism, and nutritive value of proteins. *Twice a week; both semesters. One unit.*
Professor Grindley, Dr. Mitchell

[111. Animal Nutrition.—Biochemistry, digestion, metabolism, and nutritive value of fats and lipoids, carbohydrates, and inorganic substances. *Twice a week both semesters. One unit.* (Not given, 1917–18).
Professor Grindley, Dr. Mitchell]

112. Research.—Investigations along the following lines:

(a) Economic factors involved in meat production.
Professor Mumford, Professor Coffey, Assistant Professor Rusk

(b) Systems of live stock farming. Assistant Professor Handschin

(c) The valuation of pedigrees. Professor Mumford

(d) Animal nutrition. The chemistry of feeding stuffs; metabolism experiments and biochemical studies connected with the nutrition of farm animals.
Professor Grindley, Dr. Mitchell

(e) Genetics. Problems in heredity and variation.
Assistant Professor Detlefsen

(f) Factors affecting the quality, quantity, strength, and condition of wool.
Professor Coffey

(a), (b), (c), and (f), one to three times, (d) and (e), five times a week; both semesters. One to two units. These courses may be taken during the summer by special permission.

117. Genetics.—Genetic experiments; biological and mathematical methods employed; the validity of the conclusions. *Two to five times a week; both semesters. One to two units.* Assistant Professor Detlefsen

Courses for Graduates and Advanced Undergraduates

7. Principles of Animal Nutrition.—*Five times a week; first semester.*
Professor Grindley

22. Advanced Stock Judging.—Animal conformation with reference to market and show yard form; quality and condition. *Five times a week; first semester.* Various members of the department

24. Meat.—Influence of type, condition, age, sex, and feeds on the yield and market grade of meat products. *Once a week; second semester.* Professor Coffey

26. Swine.—The economical production of pork. Problems and methods. *Once a week; second semester.* Mr. Carmichael

27. Sheep Husbandry.—The industry in leading sheep growing countries and particularly in different parts of the United States. *Once a week; second semester.* Professor Coffey

28. Advanced History of Breeds of Live Stock.—Methods of prominent breeders, and performances of great individual animals: beef, horses, sheep, and swine. *Once a week; first semester.* Professor Mumford and other members of the department

29. Systems of Live Stock Farming.—Farm management applied to live stock farming. *Twice a week; second semester.* Assistant Professor Handschin

30. Genetics.—Heredity and variation. *Daily; second semester.* Assistant Professor Detlefsen

31. Advanced Course in Animal Nutrition.—Digestion; histology and composition of body tissues; metabolism of food nutrients; effect of food nutrients on metabolism; the fasting catabolism; food requirements and feeding standards; growth; nutritive value of proteins and amino acids. *Five times a week; second semester.* Dr. Mitchell

32. Marketing Live Stock.—*Twice a week; second semester.* Professor Mumford, Mr. Wilcox

ARCHITECTURE AND ARCHITECTURAL ENGINEERING

The prerequisite for graduate work in architecture and architectural engineering is the equivalent of the undergraduate courses required at the University of Illinois for the degree of Bachelor of Science in architecture and architectural engineering in the branches of the subjects in which registration is desired.

Courses for Graduates

101.—Architectural Construction.—Design of special structures. *Twice a week; both semesters. One-half to one unit.* Professor Ricker and Professor Provine

102. Sanitation of Buildings.—Planning, design, and installation. *Twice a week: first semester. One-quarter to one-half unit.* Professor Ricker

103. Advanced Architectural Graphics.—*Twice a week; both semesters. One to two units.* Professor Provine

104. Architectural Design.—Advanced course. *Twice a week; both semesters. One to four units.* Assistant Professor Ash

105. Architectural Practise.—Contracts, specifications, and office methods. *Twice a week; first semester. One-quarter to one-half unit.* Professor Provine

106. Architectural History.—Special research. *Twice a week; both semesters. One-half to two units.* Professor Ricker

ASTRONOMY

The prerequisites for graduate study in astronomy are mathematics through the calculus, a year's course in observational astronomy, and a course in college physics.

Courses for Graduates

101. SEMINAR. *Three times a week: both semesters. One unit.*
Professor STEBBINS

102. STELLAR ASTRONOMY.—Orbits of binary stars; variable stars; theoretical photometry. *Three times a week; both semesters. One unit.*
Professor STEBBINS

Courses for Graduates and Advanced Undergraduates

7–8. THEORETICAL ASTRONOMY.—Celestial mechanics; theory of orbits; perturbations; canonical transformations. *Three times a week; both semesters. One unit.* Dr. REED

14. OBSERVATIONAL ASTRONOMY.—The working methods of an astronomical observatory. *Three times a week; second semester. One unit.* Mr. KIESS

15. GEODETIC ASTRONOMY.—The sextant, transit, and zenith telescope; methods similar to those of the United States Coast Survey. *Three times a week; first semester. One unit.* Mr. KIESS

BACTERIOLOGY

Instruction in bacteriology is offered by the departments of agronomy, botany, chemistry, and dairy husbandry. The work is offered under the supervision of a committee representing these departments.

Students who take a major in bacteriology must have had 10 semester hours of bacteriology and 15 semester hours of chemistry. The thesis may be chosen in any one of the following fields: general bacteriology, bacteriology of the dairy, of soils, of water and sewage, of animal diseases, or of plant diseases.

Candidates for the doctor's degree, with a major in bacteriology, will be held responsible for a general knowledge of all of the above mentioned fields in bacteriology.

A candidate for the doctor's degree, with a major in some field other than bacteriology, who elects a first or second minor in bacteriology must offer a minimum of four units for the first minor and a minumum of three units for the second minor selected from the courses listed below.

Courses for Graduates

BACTERIOLOGY

103. PHYSIOLOGY OF BACTERIA.—Fermentation; growth and death of bacteria. *Once a week; first semester. One unit.* Dr. SPERRY

105. CLASSIFICATION OF BACTERIA.—Variability of species; characters; mutations; standard and biometrical classification. *Once a week; second semester. One unit.* Dr. SPERRY

107. Research.—(For those students who are taking a major in bacteriology either for the doctor's degree or the master's degree. Thesis work may be taken in any of the fields indicated below.) *Once a week; both semesters. One-half unit to four units.*

General Bacteriology	Dr. Sperry
Dairy Bacteriology	Professor Harding
Pathogenic Bacteriology	Dr. Sperry
Plant Pathology	Professor Stevens
Water and Sewage Bacteriology	Professor Bartow

Agronomy

118. Investigations in Soil Biology.—Special problems. *Consultation one to five times a week for different students; both semesters. One to four units.* Dr. Whiting

Botany

106. Plant Pathology.—Diseases of plants and disease agents. *Once a week; both semesters. One-half to two units.* Professor Stevens

Chemistry

110. Water Supplies.—Sources of contamination of water supplies; purification of water for potable or technical use. *One to five times a week; both semesters. One-half to one and one-half units.* Professor Bartow

Dairy Husbandry

104. Scientific Readings.—French or German texts. (Recommended for first and second year students.) *Once a week; both semesters. One-half unit.* Professor Harding, Assistant Professor Prucha

105. Bacteriological Literature.—Each student is required to prepare and deliver an acceptable course of lectures. (Recommended for second year and third year students.) *Once a week or once in two weeks; both semesters. One-half or one unit.* Professor Harding

106. Research on Assigned Problems.—Open to graduate students whose development permits their undertaking problems of dairy bacteriology with only general supervision. *Once a week; both semesters. One-half unit to two units.* Professor Harding, Assistant Professor Prucha

Courses for Graduates and Advanced Undergraduates

Bacteriology

8. Applied Bacteriology.—Water, sewage, and food bacteria. *Five times a week; second semester.* Dr. Tanner

18a–18b. Journal Meeting.—Required of all students majoring in general and pathological bacteriology. *Once a week; both semesters.* Dr. Sperry

20. General Bacteriology.—For seniors and graduate students who do not take bacteriology as a major. Assigned readings in foreign literature. *Five times a week; first semester.* Dr. Tanner

26. Pathological Bacteriology.—Cultural and morphological characteristics of disease-producing organisms; immunity and serum reactions; routine diagnostic procedure. *Three times a week; second semester.* Dr. Sperry

27. Epidemiology.—The ways in which contagious diseases are spread and their control. *Twice a week; first semester.* Dr. Sperry

Agronomy

11. Soil Biology.—Biochemical activities of soil microörganisms in relation to soil fertility. *Five times a week; second semester.* Dr. Whiting

Botany

22a. Morbid Histology.—Histology of the plant tissues; parasites in condition of disease. *Once a week; first semester.* Professor Stevens

22b. Bacterial Plant Diseases.—*Once a week; second semester.* Professor Stevens

Chemistry

10a. Study of Water Supplies.—History, sources, contamination, and standards of purity of potable waters and waters for industrial purposes; analytical methods. *Three times a week; second semester.* Professor Bartow

Dairy Husbandry

11. Dairy Bacteriology.—Bacteria in milk and its products; sources, effect on milk, and methods of control. *Twice a week; first semester.* Professor Harding

12a–12b. Laboratory work supplementing Dairy Husbandry 11. *Four times a week; both semesters.* Professor Harding, Mr. Allen

BOTANY

Candidates for advanced degrees in botany must offer for admission at least 20 hours in university botany, or 15 hours in botany and 5 hours in zoology or 5 hours in entomology; the botany to be exclusive of general botany and inclusive of morphology of thallophytes, plant physiology, taxonomy of cormophytes, and advanced work in either plant pathology, plant anatomy or physiology, or taxonomy of cormophytes, or plant ecology.

Graduate students who desire to elect botany for minor credit must offer the equivalent of 10 hours in university botany, exclusive of general botany, as a prerequisite to the courses listed for graduates and advanced undergraduates.

Courses for Graduates

101. Individual Plant Development.—Origin of the individual; external and internal factors in its development and physiologic performance; response of the cell, somatic and generative, to external factors. *Once a week; both semesters. One-half to two units.* Professor Hottes

102. Physiology.—Effects of external stimuli on growth and movement. *Once a week; both semesters. One-half to two units.* Professor Hottes

104. Mycology.—Field and laboratory investigations of selected groups of fungi. *Once a week; both semesters. One-half to two units.* Professor Stevens

106. Plant Pathology.—Diseases of plants, and disease agents. *Once a week; both semesters. One-half to two units.* Professor Stevens

108. Taxonomy.—Monographic studies of critical groups. *Once a week; both semesters. One-half to two units.* Professor Trelease

109. Ecology.—The interrelation of plants and their environment. *Once a week; both semesters. One-half to two units.* Dr. McDougall

Courses for Graduates and Advanced Undergraduates

7b. Methods in the Study of Fungi.—Isolation, cultivation, and inoculation of fungi and bacteria. *Once a week; second semester.* Professor Stevens

9a–9b. Plant Anatomy or Physiology.—Problems to meet the needs of individual students. *Once a week; both semesters.* Professor Hottes

10a–10b. Current Botanical Literature.—A weekly review covering the field of botany; supplementary to the various seminar conferences. *Once a week; both semesters.* Professor Trelease

16a–16b. Taxonomy and Morphology of Algae and Bryophytes.—Advanced practise on selected groups. *Once a week; both semesters.* Dr. Hague

17a–17b. Taxonomy of Cormophytes.—Advanced practise on selected taxonomic or economic groups. Specialized studies, as of genera or families of Illinois plants. *Once a week; both semesters.* Professor Trelease

22a. Morbid Histology.—Histology of plant tissues; parasites in condition of disease. *Once a week; first semester.* Professor Stevens

22b. Studies of Special Groups of Fungi or Diseases of Special Crops or Groups of Crops.—*Once a week; second semester.* Professor Stevens

25a–25b. Plant Ecology.—The ecology of plants or of plant communities. *Once a week; both semesters.* Dr. McDougall

28a–28b. Taxonomy of Economic Fungi.—Advanced practise on selected groups of parasitic fungi. *Once a week; both semesters.* Professor Stevens

BUSINESS ORGANIZATION AND OPERATION

Work may be done in the field of business organization and operation for a major or a minor for the M.S. degree, and for a minor for the doctorate. To carry on graduate work in this field, students must have at least five semester hours' credit in the principles of economics and at least six semester hours in accounting and business law, respectively. To do major work in this field, the student must have completed an undergraduate curriculum equivalent to that of the college of commerce and business administration.

Courses for Graduates

[101. Regulation and Control of Mercantile Distribution.—Federal, state, and local regulation of mercantile business; unfair competition; trade agreements; trade marks; inspection of mercantile establishments; pure food acts; control over weights and measures, packing, storage, and shipment. *Twice a week; both semesters. One unit.* (Not given, 1917–18.) Assistant Professor Young]

102. Scientific Management.—The history of the scientific management movement; critical study of the proposed systems. *Twice a week; both semesters. One unit.* Assistant Professor Young

Courses for Graduates and Advanced Undergraduates

4. Industrial Organization and Management.—Problems of organization and of administrative policy; supervision and management of industries and industrial units, etc. *Twice a week; second semester.* Assistant Professor Young

CERAMIC ENGINEERING

Graduate work leading to degrees in either ceramic chemistry or ceramic engineering is offered by the department. Students who have specialized in chemistry, chemical engineering, or ceramic engineering during their undergraduate course will ordinarily be qualified to enter on graduate work leading to higher degrees in ceramic chemistry, while students who have specialized in mechanical engineering, ceramic engineering, or chemical engineering in their undergraduate course will ordinarily be qualified to pursue graduate work leading to the higher degrees in ceramic engineering. Graduate students who wish to elect ceramic chemistry as their major field of study must have had the equivalent of twenty-five semester hours in chemistry and this must include satisfactory courses in general chemistry, qualitative and quantitative analysis, and either physical or organic chemistry. Such students must also have had at least one year of college physics and a training in mathematics which includes the calculus.

Candidates for the degree of Doctor of Philosophy in ceramic chemistry must fulfill the same general requirements in chemistry as candidates in other branches of chemistry. They must also offer physical chemistry as one of their minor subjects.

Courses for Graduates

101. The Chemistry of the Compounds of Silicon.—*Twice a week; both semesters. Three-fourths unit.* Professor Washburn

103. Silicon Chemistry.—Laboratory to supplement course 101, which must precede or accompany it. *One to two units. Second semester.* Professor Washburn

102. General Technology of the Clay Industries.—Physical properties of ceramic materials and products; dependence on chemical composition, mineralogical constitution, and physical condition. *One to two units. Both semesters.* Professor Parmelee

Courses for Graduates and Advanced Undergraduates

4. Drying and Burning.—Chemical and physical processes; types of equipment. *Four times a week. First semester.* Assistant Professor Hursh

5. Ceramic Bodies.—Composition and properties of ceramic body mixtures; effects of various ingredients; development of special bodies. *Second semester; daily.* Professor Parmelee, Mr Arnold

6. Glazes.—Classes of glazes and enamels; composition, limits,pro perties, and defects. *First semester; daily.* Professor Parmelee, Mr. Arnold

8. Glass.—Raw materials, preparation, compounding, melting, and shaping; chemical principles in the manufacture and decoration of vitreous silicates. *Second semester; twice a week.* Professor Parmelee, Mr. Arnold

9. Ceramic Construction.—Plans, specifications, and estimates for ceramic equipments and industrial plants. *Second semester; four times a week.* Assistant Professor Hursh

10. Cements.—Cements, limes, plasters; composition; reactions; manufacture and testing. *First semester; three times a week.* Assistant Professor Hursh

13. Cement Laboratory.—Silicate cements. *Second semester; three times a week.* Assistant Professor Hursh

14. Cement Laboratory.—Lime and gypsum products; magnesia and other special cementing materials. *Second semester; three times a week.* Assistant Professor Hursh

15. Glass Laboratory.—Soda-lime, potash-lime, lead, barium, and zinc silicates; boro-silicates; fused and solidified glasses; problems. *Second semester; three times a week.*

16. Glasses and Enamels.—(Continuation of Ceramic Engineering 15.) Opaque, colored, and optical glasses; the enameling of metals. *Second semester; three times a week.*

17. The Principles of Physical Chemistry with Special Reference to their Applications to Ceramic Materials and Processes.—*First semester; three times a week.* Professor Washburn

18. Ceramic Microscopy.—The use of the microscope in the examination of ceramic materials and products. *First semester; three times a week.* Mr. Arnold

CHEMISTRY

Graduate students who elect chemistry as their major subject of study must have had the equivalent of 25 semester hours in chemistry, including satisfactory courses in general chemistry, qualitative and quantitative analysis, and either physical chemistry or organic chemistry. They must also have had at least one year of college physics and a training in mathematics which includes analytical geometry and, for those who do not present an acceptable course in physical chemistry, the calculus. The ability to use the calculus is a prerequisite to all courses in physical chemistry.

Before receiving a degree in chemistry the student must have completed work equivalent to courses 31, 33 (or 102 and 102a), 14a, 14b, 9a, 9b. He is advised to take at least brief courses in the history of chemistry, gas analysis, iron and steel analysis, water analysis, assaying, and chemical technology.

For students taking chemistry as a major, courses 14a, b, c, and d, 31, and 33 will be accepted only if on entering the Graduate School they have had the equivalent of 25 semester hours in chemistry.

Graduate students whose major subject is in some other department than chemistry, must have had the equivalent of 15 semester hours in chemistry. The ground covered must include satisfactory work in general chemistry and in qualitative and quantitative analysis. Such students are advised to make selections

from the following courses: Chemistry 31, 33, (or 102, 102a), 14a, 14b, 9a, 9b, 15, and 25. Students will not be admitted to courses of a special nature, for graduate credit, unless they have previously taken the appropriate prerequisite courses from the above list.

Courses for Graduates

[102. Advanced Physical Chemistry.—(This course with 102a covers a period of two years.) Thermodynamic methods. The first and second laws; the classical analytical method; Nernst heat theorem; energy, entropy, free energy, thermodynamic potential and fugacity; behavior of pure substances, solutions, heterogeneous systems, and chemical equilibria. *Twice a week; both semesters. Three-fourths unit.* (Not given, 1917–18.) Professor Tolman]

102a. Advanced Physical Chemistry.—(A continuation of 102.) Kinetic-molecular methods; kinetic theory of gases; entropy and probability; the quantum theory; molecular structure of liquids and solids; electron theory of matter; structure of the atom. *Twice a week; both semesters. Three-fourths unit.*
Professor Tolman

102b. Advanced Electrochemistry.—Modern theories of solution; thermodynamics; transformation of chemical and electrical energy. *Three times a week; first semester. One unit.*

102c. Advanced Problems in Physical and Electrochemistry.—*First semester. One-half to one unit.* Professor Tolman

102e. Special Topics in Physical Chemistry.—Subject for 1916–17: General deductive methods. *Once a week; first semester. One-half unit.*
Professor Tolman

[102f. The Chemistry and Physics of Colloids.—Classification of disperse systems; adsorption; ultramicroscopy. Electrical, chemical, optical, and catalytic properties of colloids. *Twice a week; first semester. Three-fourths unit.* (Not given, 1917–18, alternates with 102b.)]

103. Advanced Inorganic Chemistry.—Descriptive inorganic chemistry; the rarer elements; periodic system. *Two to five times a week; both semesters. One-half to one and one-fourth units.* Dr. Hopkins

103a. Advanced Analytical Chemistry.—*One to five times a week; second semester. One-half to one and one-fourth units.* Assistant Professor Smith

103b. Special Topics in Inorganic Chemistry.—Subject for 1917–18: The chemistry of the higher order compounds. *Twice a week; first semester. Three-fourths unit.* Assistant Professor Smith

103c. Special Topics in Inorganic Chemistry.—The determination of atomic weights. *Once a week; both semesters. One-fourth unit.* Dr. Hopkins

104. Advanced Organic Chemistry.—Geometric isomerism; optical isomerism; tautomerism; mechanisms of important reactions. *Twice a week; first semester. Three-fourths unit.* Assistant Professor Adams

104a. Advanced Organic Chemistry.—Special topics. Carbohydrates; proteins; ureides; alkaloids; terpenes; relationships between chemical constitution and physiological properties; color and constitution; trivalent carbon; bivalent carbon. *Twice a week; second semester. Three-fourths unit.* Dr. Kamm

104b. Advanced Quantitative Organic Analysis.—The proteins, alkaloids, glucosides, volatile oils, and other constituents of animal and vegetable tissues. *Twice a week; both semesters. Three-fourths unit.* Dr. Beal

104c. Organic Chemistry.—Current literature. *Once every two weeks; both semesters. One-fourth unit.* Assistant Professor Adams, Dr. Kamm

104d. Advanced Organic Chemistry.—The benzene, naphthalene, and anthracene compounds; pyridines; pyroles. *Twice a week; first semester. Three-fourths unit.* Assistant Professor Adams

105. Advanced Physiological Chemistry.—Structure and distribution of proteins; intermediary metabolism and the glands of internal secretion. *Twice a week; second semester. Three-fourths unit.* Dr. Muncie

105a. Advanced Physiological Chemistry.—Difficult biochemical preparations; the use of the newer analytical methods. *One to five times a week; first or second semester. Three-fourths unit.* Dr. Lewis

105b–105c. Advanced Physiological Chemistry.—Recent development. *Twice a week; both semesters. One-half unit.* Dr. Lewis

105d. Chemistry of Plant Nutrition.—Organic compounds in plants. *Two to four times a week; both semesters. Three-quarters to one and one-fourth units.* Dr. Beal

106. Animal Chemistry (Animal Nutrition).—*Five times a week; both semesters. One to one and one-half units.* Professor Grindley

107. Special Coal Problems.—Oxygen absorption; storage factors; deterioration and spontaneous combustion; unit coal values; contracts; specifications; inspection. *One to two times a week; first semester. One-fourth to one-half unit.* (Given first semester, 1917, and alternately with 107a.) Professor Parr

107a. Fuel Technology.—Fuel types: solid, liquid, and gaseous; sources, output, prospective supply, and industrial interrelations; conservation and combustion problems. *One to two times a week; first semester. One-fourth to one-half unit.* (Given first semester, 1918, and alternately with 107.) Professor Parr

107b. Special Topics in Gas Engineering.—Carbonization processes; by-product constituents and recovery. *One to two times a week; second semester. One-fourth to one-half unit.* Professor Parr

108. Advanced Metallography.—Selected alloy systems; correlation of constitution and properties. *Twice a week; first semester. Three-fourths unit.* Associate Professor McFarland

109. Advanced Industrial Chemistry.—Chemical industries; development and chemical control of processes. *Twice a week; both semesters. Three-fourths unit.* Associate Professor McFarland

110. Water Supplies.—Sources of contamination of water supplies; purification for potable or technical use. *One to five times a week; both semesters. One-half to one unit.* Professor Bartow

111. Research.—*Once a week; both semesters.*

Physical and Electrochemistry. Professor Tolman
Inorganic Chemistry. Assistant Professor Smith, Dr. Hopkins, Dr. Deming
Analytical Chemistry. Assistant Professor Smith
Food Chemistry. Dr. Beal

ORGANIC CHEMISTRY. Professor NOYES, Assistant Professor ADAMS, Dr. KAMM
WATER CHEMISTRY. Professor BARTOW
PHYSIOLOGICAL CHEMISTRY. Dr. LEWIS
ANIMAL CHEMISTRY (NUTRITION). Professor GRINDLEY
INDUSTRIAL CHEMISTRY. Professor PARR, Associate Professor MCFARLAND
CERAMIC CHEMISTRY. Professor WASHBURN

Courses for Graduates and Advanced Undergraduates

*6. CHEMICAL TECHNOLOGY.—Technological chemistry as illustrated in those industries having a chemical basis for their principal operations and processes. *Three times a week; second semester.* Associate Professor MCFARLAND

*7. METALLURGY.—General metallurgy; metallurgy of iron and steel. Fulton's *Principles of Metallurgy;* Stoughton's *Iron and Steel. Three times a week; first semester.* Associate Professor MCFARLAND

7a. METALLURGY OF THE NON-FERROUS METALS.—Copper, lead, zinc, gold, and silver. *Three times a week; second semester.* Associate Professor MCFARLAND

9. ELEMENTARY ORGANIC CHEMISTRY.—Compounds of carbon. *Three times a week; second semester.* Assistant Professor ADAMS

9c. ELEMENTARY ORGANIC CHEMISTRY.—Laboratory to accompany course 9. *Twice a week; second semester.* Assistant Professor ADAMS

10a. STUDY OF WATER SUPPLIES.—History, sources, contamination, and standards of purity of potable waters and waters for industrial purposes; analytical methods. *Three times a week; second semester.* Professor BARTOW

14a–14b. ORGANIC CHEMISTRY.—Noyes's *Organic Chemistry.* (This course should be accompanied by Chemistry 14c and 14d.) *Four times a week, first semester; twice a week, second semester.* Professor NOYES

14c. ORGANIC CHEMISTRY LABORATORY.—Organic synthesis. *Twice a week; first or second semester.* Assistant Professor ADAMS, Dr. KAMM

14d. ORGANIC CHEMISTRY LABORATORY.—Organic synthesis; quantitative and qualitative analysis. (Continuation of 14c, to accompany 14b.) *Twice a week; first or second semester.* Assistant Professor ADAMS, Dr. KAMM

15. PHYSIOLOGICAL CHEMISTRY.—*Five times a week; first semester.* Dr. LEWIS

15a. PROBLEMS OF METABOLISM—Intended especially for Medical Students. *Twice a week; second semester.* Dr. LEWIS

21. QUALITATIVE ORGANIC ANALYSIS.—Identification of pure organic compounds and mixtures. *Twice a week; first semester.* Dr. KAMM

25. FOOD ANALYSIS.—Quantitative organic analysis, with special reference to the examination of food products: alcohols, carbohydrates, fats and oils, cereals, nitrogenous bodies, preservatives, and colors. *Five times a week; first semester.* Dr. BEAL

27. QUALITATIVE ANALYSIS OF THE RARE ELEMENTS.—*Three times a week; second semester.*

28. ADVANCED QUALITATIVE ANALYSIS.—Designed especially for those intending to teach qualitative chemistry. *One to three times a week; first semester.*

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*Certain required inspection trips will be arranged in connection with courses 6 and 7. Students registering in these courses should take into consideration the expense involved, which will approximate $15.00 for each course.

31. Elementary Physical Chemistry.—Physical chemistry and electrochemistry. *Four times a week; second semester.* Professor Tolman

33. Elementary Physical Chemistry.—Molecular weights in gases and in solutions; chemical equilibrium; electrical conductivity of solutions and the phenomena within the solution; thermochemistry. (Laboratory to accompany course 31.) *Twice a week; second semester.* Dr. VanRossen

35. Electrochemistry.—Electrochemical reactions. Technical applications, including electric furnace processes. *Three times a week; first semester.*

45. Chemical Calculation.—Analytical, industrial, and physical chemistry; labor saving devices and instruments; graphical methods in the interpretation of chemical data. *Twice a week; first semester.* Dr. Deming

61. Industrial Chemistry Laboratory.—The preparation and purification of chemical products from raw materials on a scale sufficient to afford data for determining the economy of the processes employed. (This course should be accompanied by either 6 or 109.) *Three times a week; second semester.*
Associate Professor McFarland, Mr. Taylor

65. Fuels and Flue Gases.—Fuel inspection; gas analysis; determination of calorific values; calculation of efficiencies. *Three times a week, first or second semester.* Professor Parr, Dr. Broderson

66. Gas Engineering.—Gas machinery; ovens and appliances for carbonization; recovery of by-products. *Once a week; second semester.* Professor Parr

66a. Control Processes in Gas Manufacture.—Standardization methods; gas yield; inspection of by-product. *Once a week; second semester.*
Professor Parr, Dr. Broderson

69. Metallurgical Laboratory and Assaying.—The fire assay of gold, silver, lead, and copper ores, mattes, and bullion. *Twice a week; first semester*
Associate Professor McFarland

70. Advanced Assaying and Ore Testing.—(A continuation of Chemistry 69.) *Twice a week; second semester.* Associate Professor McFarland

[71. Advanced Methods of Metallurgical Analysis.—Analyses of ores, alloys, and metallurgical products. *Twice a week; first semester.* (Not given, 1917–18.) Associate Professor McFarland]

72. Paints, Oils, Turpentines, Varnishes, and Protective Coverings for Wood and Metals.—*Twice a week; first semester.* Professor Parr

76. Chemistry of Oils.—Fractionation; analysis; evaluation for fuel; gas manufacture; lubrication. *Twice a week; second semester.* Given in 1918 and in alternate years. Professor Parr

77. Composition and Classification of Coal.—Classification; changes in composition; weathering; spontaneous combustion; formation of mine gases. *Once a week; second semester.* Professor Parr

78. Metallography.—Constitution and microstructure of metals and alloys; properties, chemical and mechanical treatment, and structure. *Twice a week; second semester.* Associate Professor McFarland

95. History of Chemistry.—*Twice a week; first semester.*
Assistant Professor Smith

Besides the formal courses outlined above, regular scientific meetings are held by the colloquiums of industrial, physical, inorganic, physiological, and organic chemistry; by the Chemical Club; by Phi Lambda Upsilon, and by the University of Illinois Section of the American Chemical Society.

CIVIL ENGINEERING

The prerequisite for graduate work in civil engineering is the equivalent of the undergraduate courses required for the degree of Bachelor of Science in civil engineering in the branches of the subject in which registration is desired.

Courses for Graduates

101. Irrigation and Drainage.—Survey, examination, construction, maintenance, and operation of works for irrigation and drainage of agricultural lands: the rights to the use of water. *Twice a week; both semesters. Half unit.*

Professor Newell

[106. Reinforced Concrete Design.—Elasticity to specifications; concrete forms; typical structures; methods amd costs. *Twice a week; both semesters. One and one-half units.* (Not given, 1917–18.)]

107. Bridge Engineering.—Deflections; the statically indeterminate frame; swing bridges and arches; special graphical methods; suspension bridges; secondary stresses; impact. *Twice a week; both semesters. One unit or more.*

Professor Ellis

124. Steel Building Construction.—Steel framing of fireproof office, industrial, and hotels buildings; wind bracing; long columns; eccentrically loaded columns; eccentric connections; analysis of special details; erection methods and cost. *Twice a week; both semesters. One unit or more.*

Assistant Professor Wilson

Courses for Graduates and Advanced Undergraduates

60. Structural Stresses.—The determination of stresses in roofs, bridges, and steel-skeleton buildings, by algebraic and graphic processes. *Four times a week; second semester.* Professor Ellis

83. Bridge Design.—Determination of stresses and sections of a plate girder and a truss span; stress sheet, general design drawings, and estimate of weights. *Three times a week; first semester.* Assistant Professor Wilson

87. Advanced Bridge Analysis.—Continuous, draw, cantilever, suspension, and metal-arch bridges. *Twice a week; first semester.* Professor Ellis

[88. Steel Building Design.—Stresses and sections of the steel frame of mill and office buildings; footings and grillages; design drawings and estimate of weights. *Twice a week; second semester.* (Not given, 1917-18.)

Assistant Professor Wilson]

89. Hydro Economics.—The occurrence of water in nature; conservation, regulation and use of water for power and in various industries; irrigation, drainage, transportation, domestic supply; the legal title to the use of water. *Twice a week; first semester.* Professor Newell

THE CLASSICS.

The Degree of Master of Arts in the Classics.—The major may be either Latin or Greek.

Before the period of the regular course examinations of the second semester, each candidate must also pass two examinations which are to be regarded as tests of attainment rather than as a requirement of special or additional preparation. The first examination consists of written translation at sight, from the candidate's major language, of passages equivalent in difficulty to the work of first-year graduate courses. The second examination is oral and designed to determine the candidate's general ability and his advancement in the various fields of classical philology, especially those treated in course 110, Bibliography and Criticism.

The Degree of Doctor of Philosophy in the Classics.—The degree is given in classical philology. Major work may be taken in either Latin or Greek, but whichever language is taken as a major, the other must be taken as the first minor.

Greek

Preparation for first-year graduate work in Greek must include at least two years of preparatory Greek, two years of college Greek, and two years of college Latin. A reading knowledge of French or German, preferably the latter, is highly desirable for candidates in this subject. The study of history and philosophy is especially recommended.

Courses for Graduates

[104. Homer and the Homeric Question.—*Twice a week; both semesters. One unit.* (Not given, 1917–18.) Professor Oldfather]

105. Plato and Aristotle.—*Twice a week; first semester. One unit.* Professor Oldfather

[107. Greek Drama.—*Twice a week; both semesters. One unit.* (Not given, 1917-18.) Professor Moss]

108. Greek Oratory.—Speeches of several orators are read rapidly, and a detailed study made of one or two authors. *Twice a week; both semesters. One unit.* Professor Moss

Courses for Graduates and Advanced Undergraduates
(For minor credit only)

[5. Herodotus: The Lyric Poets.—Selections. *Three times a week; second semester.* (Not given, 1917–18.) Professor Moss]

6. Thucydides.—Books VI–VII. *Three times a week; first semester.* Professor Moss

[7. The Drama.—*Three times a week; second semester.* (Not given, 1917–18.) Professor Moss]

8. Plato.—Selected Dialogues, including Phaedo; the Apology. *Three times a week; second semester.* Professor Pease

21. See Latin 21.

Latin

Preparation for first-year graduate work in Latin must include at least two years of preparatory Latin, and four years of college Latin, or three years of preparatory

Latin and three years of college Latin. A reading knowledge of French or German, preferably the latter, is highly desirable. Some acquaintance with Greek is indispensable, and the study of history and philosophy is especially recommended.

Courses for Graduates

[102. ROMAN ORATORY.—*Twice a week; second semester. One unit.* (Not given, 1917–18.) Associate Professor CANTER]

103. CICERO.—The De Natura Deorum and the De Divinatione. The Epicurean, Stoic, and Academic theories of religion and their relation to the popular worship. *Twice a week; second semester. One unit.* Professor PEASE

104. LATIN PALAEOGRAPHY.—Material and form of ancient books; methods of copying; common errors in manuscripts; facsimiles of codices; text criticism. *Twice a week; first semester. One unit.* Professor PEASE

[106. TERENCE.—*Twice a week; second semester. One unit.* (Not given, 1917–18.) Professor OLDFATHER]

107. LATIN EPIGRAPHY.—Forms and language of inscriptions; selections from the Corpus Inscriptionum Latinarum. *Twice a week; second semester. One-half to one unit.* Professor PEASE

108. TACITUS.—The Histories. *Twice a week; first semester. One unit.* Professor BARTON

109. VIRGIL.—*Twice a week; second semester. One unit.* Professor PEASE

112. ROMAN HISTORIOGRAPHY.—*Twice a week; second semester. One unit.* Associate Professor CANTER

113. PLAUTUS.—*Twice a week; first semester. One unit.* Professor OLDFATHER

[114. CAESAR.—Historical works, especially the Bellum Gallicum. *Twice a week; second semester. One unit.* (Not given, 1917–18.) Professor OLDFATHER

[115. ROMAN ELEGY.—Relation to other lyric forms; translations from Catullus, Tibullus, and Propertius. *Twice a week; second semester. One unit.* (Not given, 1917-18.) Associate Professor CANTER]

Courses for Graduates and Advanced Undergraduates

[7. SATIRE.—Selected Satires and Epistles of Horace and selected Satires of Juvenal. *Three times a week; first semester.* (Not given, 1917-18.) Professor PEASE]

8. TACITUS.—The Annals, books I–VI. *Three times a week; first semester.* Professor PEASE

[14. SENECA.—Letters and tragedies. *Three times a week; second semester.* (Not given, 1917–18.) Professor BARTON]

16. MARTIAL AND SUETONIUS.—*Three times a week; second semester.* Professor BARTON

22. LATE LATIN.—Rapid reading of selections from Latin writers from Minicius Felix to Cassiodorus. *Twice a week; second semester.* Professor PEASE

[21. SPECIAL TOPICS IN THE HISTORY OF GREECE AND ROME.—*Twice a week; second semester.* (Not given, 1917–18.) Professor OLDFATHER]

Classical Philology

110. Thesis Course: Bibliography and Criticism.—All graduate students who are taking Latin or Greek as a major for the master's degree must take this course. *Once a week; both semesters. One unit.*

Professors Oldfather, Pease, Canter, and others

Attention is also called to Comparative Philology 2,—Comparative Philology in the Indo-European Languages.

COMPARATIVE PHILOLOGY

For Graduates and Advanced Undergraduates

1. Introduction to the Study of Language.—Phonetics; the development of forms of speech; dialects and the spread of languages; the study and teaching of languages. *First semester; three times a week.* Assistant Professor Bloomfield

2. Comparative Philology of the Indo-European Languages.—Greek, Latin, and the Germanic languages, including English. *Second semester; twice a week.* Assistant Professor Bloomfield

3. Elementary Sanskrit.—*First semester; three times a week.* Assistant Professor Bloomfield

4. Elementary Sanskrit.—(Continuation of 3.) *Second semester; three times a week.* Assistant Professor Bloomfield

DAIRY HUSBANDRY

Candidates for the master's degree may take their major work in dairy husbandry, preparing a thesis in the field of dairy bacteriology, dairy chemistry, or milk production. Such students must have had at least 10 semester hours of previous work in dairy husbandry, including adequate preparation for the desired graduate courses.

Candidates for the master's degree desiring a minor in dairy husbandry must have had the introductory work regularly required to enter the desired course or courses.

Candidates who desire to register for a doctorate with their major interest in dairy bacteriology as well as those who desire to take dairy bacteriology as a part of a minor for the doctorate should register in bacteriology according to the regulations given under bacteriology on page 27.

Courses for Graduates

101. Economic Milk Production.—Efficiency of dairy farms; factors influencing profits. *Twice a week; both semesters. One unit.* Professor Fraser

104. Scientific Readings.—German or French bacteriological text. Recommended for first-year and second-year students. *Once a week; both semesters. One-half unit.* Professor Harding, Assistant Professor Prucha

105. Bacteriological Literature.—Each student is required to prepare and deliver an acceptable course of lectures. (Recommended for second-year and third-year men.) *Once a week or once in two weeks; both semesters. One-half or one unit.* Professor Harding

106. Research on Assigned Problems.—(Open to graduate students whose development permits their undertaking problems of dairy bacteriology with only general supervision.) *Both semesters. One-half unit to two units.*

Professor Harding, Assistant Professor Prucha

107. Dairy Chemistry.—Assigned problems. *Once a week. Both semesters. One unit.*

*Courses for Graduates and Advanced Undergraduates**

11. Dairy Bacteriology.—Bacteria in milk and its products; sources, effect on milk, and method of control. *Twice a week; first semester.*

Professor Harding

12a–12b. Dairy Bacteriology.—Laboratory work supplementing Dairy Husbandry 11. *Four times a week; both semesters.*

Professor Harding, Mr. Allen

21. Economic Milk Production.—*Five times a week; second semester.*

Professor Fraser

ECONOMICS

Every student entering on major graduate work in economics must have had a course in the principles of the science and also in some special part of the field such as public finance or money and banking. The work must represent at least eight semester hours. He must also have had at least one semester's work in English, American, or general European history; and at least three hours in political science.

Those who take the subject as a minor must have had a course of at least five semester hours in the principles.

Graduate students who are making economics their major are required during their first year to acquaint themselves with the works of the masters in the science, either by taking course 101 or by private reading for examination. In the second or third year they are expected to elect courses 105 and 120, and some fundamental course in political science and sociology unless they have already had such courses.

The following courses may be taken by students in general economics for major or minor credit: all numbered above 100; 4, 5, 10, 12, 13, 19, 20, 21, 29. 51. The following may be taken for minor credit only: 8, 9, 14, 15, 17, 28, 31,

Two units will be accepted for a first minor for the master's degree; and four two or three hour graduate courses, or their equivalent in advanced undergraduate courses, for a first minor for the doctor's degree.

Courses in transportation may be included in their programs by students of economics as part of either their major or minor subjects. See Transportation.

Courses for Graduates

101. Economic Theory.—*Twice a week; both semesters. One unit.*

Professor Kinley

104. Foreign Commerce.—*Twice a week; both semesters. One unit.*

Assistant Professor Litman

*See also Bacteriology.

105. Public Finance.—*Twice a week; both semesters. One unit.*
Professor Bogart

107. The Corporation in Economic Evolution.—*Twice a week; both semesters. One unit.* Professor Robinson

[109. Theory of Industrial Consolidation.—The nature, causes, and effects of industrial consolidations; prices, profits, and wages. *Twice a week; both semesters. One unit.* (Not given, 1917–18.) Professor Robinson]

[110. Investments.—Nature, character, and function of investments; classes, including direct investments and securities of various types; methods of judging investments; state control. *Twice a week; both semesters. One unit.* (Not given, 1917–18.) Professor Robinson]

118. Seminar.—Bi-weekly discussion of the results of students' investigations. Members of the staff

120. History of Economic Thought.—*Twice a week; both semesters. One unit.* Dr. J. G. Thompson

[122. Advanced Economic History of the United States.—*Twice a week; both semesters. One unit.* (Not given, 1917–18. See Economics 19 and 20.)
Professor Bogart]

Theory of Statistics. See Mathematics 129.

Courses for Graduates and Advanced Undergraduates

4. Financial History of the United States.—*Three times a week; first semester.* Mr. Douglas

5. Public Finance.—Public debts, revenue, taxation, etc. *Three times a week; first semester.* Professor Bogart

8. The Money Market.—*Twice a week; second semester.*
Assistant Professor Weston

9. Practical Banking.—*Twice a week; first semester.*
Assistant Professor Weston

10. Corporation Management and Finance.—*Three times a week; second semester.* Professor Robinson

11. Industrial Consolidation.—Development; plans for controlling trusts. *Three times a week; first semester.* Professor Robinson

12. Labor Problems.—*Three times a week; both semesters.* Mr. Hoagland

13. Economic Development of Europe Since the Industrial Revolution. —*Three times a week; second semester.* Professor Bogart

14. Agricultural Cooperation.—Organization, financing, and management of cooperative associations for the promotion of various branches of farming. *Twice a week; second semester.* Dr. Stewart

15. Rural Credit.—*Twice a week; first semester.* Dr. Stewart

17. Economic History of Agriculture.—General characteristics of agriculture, and its development as an industry; state of the agricultural class; relation of agriculture to other industries; relation of the state to agriculture. *Twice a week; second semester.* Dr. J. G. Thompson

19. Economic History of the United States, 1820–1860.—*Twice a week; first semester.* Assistant Professor C. M. Thompson

20. Economic History of the United States Since 1860.—*Twice a week; second semester.* Assistant Professor C. M. Thompson

21. Socialism and Economic Reform.—*Twice a week; second semester.* Mr. Douglas

28. Mechanism and Technique of Domestic Commerce.—*Three times a week; first semester.* Assistant Professor Litman

29. International Trade and Trade Policies.—*Twice a week; second semester.* Assistant Professor Litman

31. Organization of Foreign Commerce.—Exporting and importing; means of communication and of transportation; the shipping business; duties of consuls. *Three times a week; second semester.* Assistant Professor Litman

EDUCATION

Students who elect education as a major subject must have completed at least a three-hour course in the principles of education, a course of at least the same length in the history of education, and a minimum of three hours each in psychology and philosophy. For graduate students who have had experience in teaching, these requirements may be modified.

Courses for Graduates

101. Seminar in Educational Theory.—*Once a week, two hours; first semester. One unit.* Professor Johnston

106. Seminar in Secondary Education.—Organization, administration, and special methods of secondary education. *Once a week, two hours; second semester. One unit.* Professor Johnston

110. Seminar in Methods of Teaching.—Individual investigations of problems of technique. *Once a week; two hours; first semester. One unit.* Professor Charters

[112. Principles of Education.—(For graduate students who are not majoring in education and who have not taken undergraduate courses in education.) The American public-school system; principles and doctrines of educational science; technique of teaching and problems of class management. *Twice a week; second semester. One-half unit.* (Not given, 1917-18.)]

119. The Elementary Curriculum.—*Twice a week; second semester. One unit.* Professor Charters

125. Seminar in Educational Psychology.—*Once a week, two hours; first semester. One unit.* Acting Professor Hill

Departmental Conference.—Every alternate Monday from 7 to 9 p. m. All graduate students majoring in education are expected to meet with the departmental staff at this time. The work carries no credit. *First and second semesters.*

Courses for Graduates and Advanced Undergraduates

4. Problems of Educational Administration.—Interpretation of present tendencies. *Three times a week; first semester.* Mr. Stevenson

5. Comparative Education.—Educational organization, administration, and basic national ideals of the schools and school systems of the United States, Germany, England and France; secondary education and the training of teachers. *Three times a week; first semester.* Acting Professor Hill

6. Principles of High-School Education—*Three times a week; first semester.* Professor Johnston

13–14. Educational Classics.—Educational writings of Plato, Aristotle, Quintilian, Montaigne, Milton, Locke, Comenius, Rousseau, Pestalozzi, Froebel, and Herbert Spencer. *Three times a week; first and second semesters.* Mr. Gorman

15. School Hygiene.—*Twice a week; second semester.* Professor Whipple

18. Method in Educational Research. *Twice a week; first semester.* Acting Professor Hill

[19. Readings in French and German Educational Literature. *Twice a week; first semester.* (Not given 1917-18.) Professor Whipple]

20a. Theory of Supervision.—*Three times a week; first semester.* Professor Charters

27. High School Curriculums.—*Three times a week; second semester.* Professor Johnston

41. Vocational Education.—*Three times a week; first semester.* Professor Johnston

42. Auxiliary Education.—Training of defectives and delinquents; the Binet-Simon tests and other methods of mental diagnosis; educational treatment of morons and of moral delinquents; methods of teaching sensory defectives (the blind and the deaf); public institutions of auxiliary education and their administration. *Three times a week; second semester.* Professor Whipple

43. Mental Tests.—Laboratory drill; tests of sensory capacities; attention; memory; learning; suggestibility; inventiveness; systems of tests for diagnosis of mental age, general intellectual status, mental retardation, etc. *Twice a week; second semester.* Professor Whipple

45. Research Problems in Educational Psychology.—*Either semester.* Professor Whipple

ELECTRICAL ENGINEERING

The prerequisite for graduate work in electrical engineering is the equivalent of the undergraduate courses required for the degree of Bachelor of Science in electrical engineering in the branches of the subject in which registration is desired.

Graduate students who wish to take a minor in electrical engineering must have had differential and integral calculus, and one year's work in college physics.

Courses for Graduates

101. Advanced Course in Alternating Currents.—The theory of transient phenomena; polyphase circuits; measuring apparatus. *Twice a week; both semesters. One and one-half units.* Professor Paine

103. Electrical Design.—Plans for an electrical machine or apparatus of specified character; or for the arrangement of an electrical plant; or for the installation of such machinery or apparatus. *Twice a week; second semester. One unit.* Assistant Professor Waldo

104. Telegraphy and Telephony.—Telegraph apparatus and methods including quadruplex systems and high speed telegraphy. Manual and automatic telephone systems. *Once a week; either semester. One unit.* Professor Brooks

105. Electrical Engineering Research.—Investigation of electrical phenomena, or tests of some electrical machine, or of a plant of such machines. *Twice a week; both semesters. One to three units.* Professor Paine

106. Illumination.—Problems in illumination; light sources. *Once a week; both semesters. One unit.* Professor Brooks

ENGLISH LANGUAGE AND LITERATURE

Students who enter on graduate work with English as their major subject are required to give evidence of their ability to write good English. They must present the equivalent of fourteen hours of undergraduate work in English literature, the required college work in rhetoric, and the equivalent of four semesters of college work in a language other than English. After the first year of graduate work a knowledge of French and German is indispensable.

Students making English their minor may be admitted to such courses as in the judgment of the instructor in charge they are qualified to pursue.

The Degree of Master of Arts in English.—In addition to complying with the general rules of the Graduate School, candidates for the degree of Master of Arts in English must comply with the following rules of the Department of English: (1) they must choose a portion of their work from the group of courses described as "for graduates"; (2) must offer an elementary course in Anglo-Saxon; and (3) must take, besides the regular semester examinations in all their courses, a general examination, oral or written as the department may prescribe, which shall be a final test of the candidate's fitness and ability.

The Degree of Doctor of Philosophy in English.—Candidates for the degree of Doctor of Philosophy in English may expect to be examined on the entire field of the English language and literature. They are urged, furthermore, to acquaint themselves as fully as possible with the history and the philosophy of the period in which their main interest lies, and with the foreign languages and literatures most closely related to English in that period.

Courses for Graduates

101. Research in Special Topics.—Guidance in writing theses for advanced degrees. *From one to two units.* Professor Sherman, Professor Dodge, Professor Bernbaum, Associate Professor Fulton, Associate Professor Paul, Assistant Professor Baldwin, Assistant Professor Scott, Assistant Professor Jones, Assistant Professor Zeitlin.

106. English Literary Criticism from Dryden to Coleridge.—*Twice a week: both semesters. One unit.* Associate Professor Fulton

[108. The English Epic in the Sixteenth, Seventeenth, and Eighteenth Centuries from the Point of View of Classical Theory.—*Twice a week; both semesters. One unit.* (Not given, 1917–18.) Associate Professor Fulton]

110. Old English (Anglo-Saxon) Poetry.—*Twice a week; first semester. One unit.* Professor Dodge

112. The History of the English Language.—*Twice a week; both semesters. One unit.* Assistant Professor Zeitlin

[114. The Development of the Essay.—The English essay; continental influences; classical origins. *Twice a week; both semesters. One unit.* (Not given, 1917–18.) Assistant Professor Zeitlin]

126. Ballads.—Studies in the relation of folk poetry to literature. *Twice a week; first semester. One unit.* Dr. Schoepperle

127. Metrical Romances.—The beginnings of verse fiction. *Twice a week; second semester. One unit.* Dr. Schoepperle

[128. Spenser and the Beginnings of the English Renaissance.—The persistence of certain medieval traditions reinforced by the Revival of Classical Learning; Catholicism and Calvinism as sources of literary inspiration. *Twice a week; both semesters. One unit.* (Not given, 1917–18.) Assistant Professor Jones]

129. English Literature from the Norman Conquest to Chaucer.—Middle English authors exclusive of Chaucer. *Twice a week; both semesters. One unit.* Assistant Professor Jones

[135. Problems in American Literature.—*Twice a week; both semesters. One unit.* (Not given, 1917–18.) Associate Professor Paul]

136. The Transition from the Seventeenth to the Eighteenth Century, 1675–1725; the Rise of Classicism.—*Twice a week; both semesters. One unit.* Associate Professor Paul

137. Prose Writers of the Nineteenth Century.—Relation of literature to social forces; Mill, Carlyle, Newman, Ruskin, Arnold, and Pater. *Twice a week; both semesters. One unit.* Professor Sherman

[138. The Romantic Movement in England.—*Twice a week; both semesters. One unit.* (Not given, 1917–18.) Professor Sherman]

140. Investigations in Modern English Literature.—(For second-year and third-year graduate students who are preparing theses for the doctor's degree.) *Three hours once a week; both semesters. One to three units.* (May be taken in successive years.) Professor Bernbaum

141. The History of Seventeenth Century English Literature to About the Year 1675.—Poetry, beginning with Shakspere's Sonnets. *Twice a week; both semesters. One unit.* (The first semester may not be taken separately.) Professor Bernbaum

[142. The Conflict of Ideas and Ideals in Eighteenth Century Literature.—*Twice a week; both semesters. One unit.* (Not given, 1917–18.) Professor Bernbaum]

143. The Origins of the English Novel, and Its History to the End of the Eighteenth Century.—*Twice a week; both semesters. One unit.* (The first semester may not be taken separately.) Professor Bernbaum

Courses for Graduates and Advanced Undergraduates

A. English Literature and Language

3. The Poetry of Milton.—Origins, forms, artistic and ethical values; Milton's place in English literary history. *Twice a week; second semester.*
Assistant Professor Baldwin

4. English Versification.—Verse forms; reading of representative poems. Verse composition; individual conferences. *Three times a week; first semester.*
Dr. Creek

5. Shakspere.—Six plays, with special emphasis on *Hamlet. Three times a week; second semester.* Professor Dodge

8–9. Old English (Anglo-Saxon.)—Grammar; prose; short poems; *Beowulf.* (The first semester may be taken separately.) *Three times a week; both semesters.* Professor Dodge

16. Development of English Prose.—Prose style from the year 1500 onward; classical and French influences. *Prerequisite: credit for either entrance or college Latin or French. Three times a week; second semester.*
Assistant Professor Zeitlin

25. Chaucer.—*Three times a week; first semester.* Assistant Professor Jones

27–28. Studies in the Relations of Journalism and Literature.—*First semester:* English Literary Periodicals and the genesis and evolution of the Periodical Essay in the 17th and 18th Centuries. *Second semester:* The Magazine in America. *Twice a week; both semesters.* Assistant Professor Scott

32. The Critical Essayists of the Nineteenth Century.—*Three times a week; second semester.* Associate Professor Fulton

35–36. English Drama (exclusive of Shakspere).—*First semester:* From the beginning to 1600. *Second semester:* From 1600 to 1700. (Either semester may be taken separately.) *Three times a week; both semesters.*
Professor Dodge, Dr. Hillebrand

37. Folk Lore.—Primitive customs and beliefs surviving in English poetry; folk lyric and drama; early satire and gnomic literature. *Twice a week; first semester.* Dr. Schoepperle

38. The Arthurian Tradition.—The historical Arthur; Celtic influences; Old French Romances (in translation); the tradition in England to the present time, with especial attention to Malory and Tennyson. *Twice a week; second semester.* Dr. Schoepperle

[39. Introduction to the Literature of the Middle Ages.—Classical influences. Principal types: epic, romance, legend, lay, allegory, fabliau, lyric. Important poems, both English and continental, will be read in translation. *Three times a week; second semester.* (Not given, 1917–18.) Dr. Creek]

41. The Teaching of English Literature.—Methods of teaching English literature in the high school. *Twice a week; first semester.*
Associate Professor Paul

42. The Teaching of English Composition.—Methods of teaching English composition in the high school. *Twice a week; second semester.*
Associate Professor Paul

45. The Development of the Modern Drama.—Dramatic tendencies in the Nineteenth century, both in England and on the Continent. *Three times a week; first semester.* Dr. Hillebrand

52. The Great Novelists of the Nineteenth Century.—Scott, Jane Austen, Dickens, Thackeray, Hawthorne, George Eliot, Meredith, Hardy, Stevenson. *Three times a week; second semester.* Professor Bernbaum

53. Matthew Arnold.—His prose and poetry with special reference to the main currents of nineteenth century thought. *Three times a week; second semester.* Professor Sherman

60a–60b. Thesis.—Special training in investigation for candidates for honors and for other seniors. *Once a week; both semesters.* Assistant Professor Zeitlin, Dr. Hillebrand, and others

B. Celtic Literature

1–2. Celtic Civilization and Literature in Translation.—(Either semester may be taken separately. This course may not be counted towards a major in English.) *Twice a week; both semesters.* Dr. Schoepperle

C. Rhetoric

15–16. Editorials and Special Articles.—The larger problems in journalistic writing; relation of history, economics, and political science to current events; editorial and feature writing. *Three times a week; both semesters.* Assistant Professor Scott

17. Advanced Composition.—Practise writing, with special emphasis on structure; criticism of current periodical literature; development of material for reports, magazine articles, etc. (Open to a limited number of students, and only on recommendation.) *Three times a week; second semester.* Mr. Weirick

ENTOMOLOGY

The prerequisite for graduate work in entomology is two years of undergraduate biology, of which one year should be zoology. Entrance on major work in entomology requires entomology 15 or its equivalent. A reading knowledge of French and German is necessary at least by the beginning of the second year.

Courses for Graduates

102. Research in the Morphology and Embryology of Insects.—*Twice a week; both semesters. One or two units.* Assistant Professor Folsom

108. Research in Economic Entomology.—*Once or twice a week; both semesters. One or two units.* Assistant Professor Folsom

109. Research in Systematic Entomology.—*Two times a week; both semesters. One or two units.* Assistant Professor MacGillivray

Courses for Graduates and Advanced Undergraduates

8. Economic Entomology.—*Three times a week; both semesters.* Assistant Professor Folsom

10. Taxonomy of Immature Insects.—External form of immature insects; identification of species. *Three times a week; both semesters.*

Associate Professor MacGillivray, Dr. Mosher

11. Classification of the Coccidae.—Preparing scale insects for study; identification of genera and species; morphology, metamorphosis, and phylogeny. *Five times a week; second semester.*

Associate Professor MacGillivray, Dr. Mosher

12. Current Literature.—*Once a week; both semesters.*

15. Introductory Course.—Metamorphosis and development of insects; orders, suborders, and families; habits of species; anatomy of immature and adult insects; special adaptive structures; classification of insects. (Not open to students who have had courses 2 and 3. Those who have had only one of these courses may take this course for one-half credit only.) *Three times a week; first semester.*

Associate Professor MacGillivray, Dr. Mosher

17. Insect Organogeny.—Adult and immature insects. *Three times a week; both semesters.* Associate Professor MacGillivray, Dr. Mosher

18. Insect Taxonomy.—Structures used in the classification of insects; identification of a representative collection of insects. *Five times a week; both semesters.*

Dr. Mosher

FRENCH

(See Romance Languages.)

GENETICS

Instruction in courses leading to advanced degrees in genetics is offered by the departments of agronomy, animal husbandry, botany, horticulture, and zoology. The work is offered under the supervision of a committee representing these departments.

The prerequisites for major work in genetics are Botany 1 and 3a, Mathematics 2 and 4, and Zoology 1 and 2, or their equivalents. A reading knowledge of German and French is indispensable.

The prerequisite for minor work is genetics is 10 hours of botany or zoology.

Courses for Graduates

Agronomy

112. Plant Breeding.—Experiments at this station; methods and results reported from other states and from foreign countries. *Twice a week; both semesters. One to two units.* Professor Smith

Animal Husbandry

117. Genetic Experiments on Animals and Plants.—Biological and mathematical methods employed; the validity of the conclusions. *Two to five times a week; both semesters. One to two units.* Assistant Professor Detlefsen

112e. Research.—Experimental investigations in heredity and variation. (This course may be taken during the summer by special permission.) *Once a week; both semesters. One to two units.* Assistant Professor Detlefsen

Botany

101. Individual Plant Development.—Origin of the individual; external and internal factors in its development and physiologic performance; response of the cell, somatic and generative, to external factors. *Once a week; both semesters. One or two units.* Professor Hottes

Zoology

115. Factors of Individual and Racial Development.—Experimental embryology; regeneration; heredity; variation; evolution. *Twice a week; both semesters. One unit. Time to be arranged.* Professor Zeleny

124. Experimental Zoology.—Individual research course. *Both semesters. One to two units. Time to be arranged.* Professor Zeleny

Courses for Graduates and Advanced Undergraduates

Agronomy

22. Plant Breeding.—The improvement by breeding of field crops, including grains, grasses, and legumes. With practical applications. *Twice a week; second semester.* Professor Smith

Animal Husbandry

30. Genetics.—Heredity, variation, elements of biometry, and their practical application to breeding. *Five times a week; second semester.* Assistant Professor Detlefsen

Botany

14a–14b. Heredity, Variation, Evolution.—Cells and members of plants; adaptations and changes; mechanism of heredity; evolution. *Twice a week; both semesters.* Professor Hottes

Horticulture

12. Evolution of Horticultural Plants.—History, botanical classification, and geographical distribution of cultivated plants; modification under culture; variation. *Three times a week; first semester.* Professor Crandall

Zoology

25–26. Experimental Zoology.—Experimental embryology; regeneration; heredity; variation; evolution. *Two to five times a week; both semesters.* Professor Zeleny

(See also Mathematics 129; Zoology 8, 20.)

GEOLOGY

For graduate work in geology the student must have a sound elementary training in the general principles of the science, and must have done advanced work in at least one of its branches. Except in unusual cases, which will be decided on their merits, at least 20 hours of geology and two weeks or more of field experience will be required. Graduate students with adequate technical preparation in other sciences may be admitted to graduate courses in certain subjects, such as crystallography.

Under the present organization of the department, major fields of study for the doctorate will normally be: (a) historical geology, including sedimentation; (b)

stratigraphy and paleontology; (c) economic geology, including mineralogy and petrology. First or second minor subjects are available as follows, except that in no case may the minor subject belong to the more comprehensive field in which the major is selected: (a) physiography; (b) stratigraphy; (c) paleontology; (d) historical geology; (e) sedimentation; (f) petrology; (g) economic geology; (h) mineralogy and crystallography (limited to students who are not majoring in geology).

A first minor presupposes 4 units, and a second minor 2 units credit.

Courses for Graduates

101. Advanced Crystallography.—The methods used in measuring, projecting, and calculating crystal forms, and determining the physical properties of crystallized bodies. *Twice a week; both semesters. One unit.* Professor Bayley

102. Igneous Petrography.—The igneous rocks; identification of types, classification, and relationships. *Twice a week; first semester. One unit.* Professor Bayley

103. Metamorphic Petrography.—Microscopy of the metamorphic rocks; interpretation of their origin. *Twice a week; second semester. One unit.* Professor Bayley

105. Paleontologic Problems.—Fossil invertebrates by zoological or faunal groups. *One to three times a week; both semesters. One unit.* Associate Professor Savage

108. Ore Deposition.—Origin of ore deposits, as illustrated by selected mining districts. *Three times a week; both semesters. One unit.* Professor Bayley

125. Sedimentation.—The interpretation of sedimentary rocks in terms of their origin. *Twice a week; both semesters. One unit.* Professor Blackwelder

[126. Historical Problems.—*Twice a week; both semesters. One unit.* (Not given, 1917–18.) Professor Blackwelder]

135. Research.—Individual work under the supervision of members of the staff in their respective fields. *Once a week; both semesters. One to four units.* Professor Blackwelder, Associate Professor Savage, Dr. Rich

136. Seminar in Physical Geology.—Special problems in mineralogy, petrography, economic geology, metamorphism, and related subjects. *Once a week; both semesters. One unit.* Professor Bayley

[137. Seminar in Historical Geology.—Historical geology, paleontology, correlation, and allied subjects. *Once a week; both semesters. One unit.* (Not given, 1917–18.) Professor Blackwelder and Associate Professor Savage]

Courses for Graduates and Advanced Undergraduates

6. Optical Mineralogy.—An introduction to the courses in petrography. *Twice a week; first semester.* Professor Bayley

7. Petrography.—The principles learned in course 6 are applied to the study of rocks. *Once a week; second semester.* Professor Bayley

[15. Structural Geology.—*Three times a week; first semester.* (Not given in 1917–18.) Professor Blackwelder]

16. Stratigraphy.—The sequence of rock formations in North America, and their index fossils. *Five times a week; second semester.* Associate Professor Savage

17. Earth History.—Physical conditions and events in the geological periods, with special reference to North America. *Three times a week; first semester.* Professor Blackwleder

23. Physiography of the Lands.—The making of topographic features as controlled by such factors as climate, and rock structure. Physiographic history. Two Saturday field trips. *Twice a week; second semester.* Dr. Rich

24. Physiographic Interpretations.—The application of physiographic principles to the interpretation of recent earth history. *Twice a week; first semester.* Dr. Rich

31. Geology of Oil and Gas.—Origin and relations of the natural hydrocarbons; their distribution both geographically and in the stratigraphic column. *Three times a week; second semester.*

41. Summer Field Survey.—For 1918 the field will probably be Eastern Wyoming. Eight weeks in summer. Party limited to 10, approved in advance. Professor Blackwelder

42. Stratigraphic Paleontology.—The invertebrate index fossils of the successive geologic formations, from the Cambrian to the Tertiary. *Three times a week; both semesters.* Associate Professor Savage

45a–45b. Geological Conference.—All members and advanced students of the department participate in this for the purpose of considering the results of investigations, reviews of important publications, and special lectures. Credit given only to those advanced students authorized to register for the course. *Once a week; both semesters.* Professor Blackwelder

GERMANIC LANGUAGES AND LITERATURE

German

Students desiring to take German as a major are required to have finished successfully a four years' course of undergraduate work in German, comprising a minimum of twenty-eight semester hours of credit. They are also required to be familiar with the principal works of the writers of the classical and modern periods of German literature, to show a general knowledge of the history of German literature, and to be able to follow lectures in the German language.

Of collateral subjects, a reading knowledge of Latin and French is required. It is desirable that candidates for the degree of Ph.D. have some knowledge of Greek. All students are to have had a course in German history.

Courses for Graduates

101. Seminar in Germanic Philology.—Training in original research. Results, when of value, may be published in the *Journal of English and Germanic Philology. Once a week; both semesters. One unit.* Professor Goebel

103. Introduction to the Historical Study of the Germanic Languages.—History of German philology; comparative grammar of the old Germanic dialects. *Twice a week; second semester. One unit.* Professor Goebel

104. Gothic.—Grammar and literature. *Twice a week; first semester. One unit.* Professor Goebel

105. Old High German.—Grammar and interpretation of the oldest literary documents. *Three times a week; second semester. One unit.* Dr. Williams

[109. Goethe's and Schiller's Philosophy.—*Twice a week; both semesters. One unit.* (Not given, 1917–18.) Professor Goebel]

110. Early German Drama.—German drama up to the Reformation: medieval religious drama, Shrovetide plays, beginnings of the humanistic drama. *Twice a week; first semester. One unit.* Assistant Professor Brooks

113. German Literature of the Fifteenth and Sixteenth Centuries.—Luther and the Reformation, Mastersingers and Folksong, the Reformation drama. Hans Sachs, Brant, Fischart, the chap books, the English comedians. *Twice a week; second semester. One unit.* Assistant Professor Brooks

115. History of German Literature During the Nineteenth Century.—*Twice a week; both semesters. One unit.* Professor Lessing

[116. Medieval German Literature with Reference to Political, Religious, and Social History.—Research course. *Twice a week; both semesters. One unit.* (Not given, 1917–18.) Professor Lessing]

117. History of German Literature During the Eighteenth Century.—*Twice a week; both semesters. One unit.* Professor Goebel

[118. The German Drama Since Schiller.—Research course. *Twice a week; both semesters. One unit.* (Not given, 1917–18.) Professor Lessing]

119. The German Novel.—Research course. *Twice a week; both semesters. One unit.* Professor Lessing

121. Walther von der Vogelweide.—*Twice a week; second semester. One unit.* Professor Goebel

[121b. Nibelungenlied.—*Twice a week; second semester. One unit.* (Not given, 1917–18.) Professor Goebel]

[125. History of the German Language.—Evolution of the forms, syntax, and lexicography of the High German literary language. *Three times a week; second semester. One unit.* (Not given, 1917–18.)

Courses for Graduates and Advanced Undergraduates

8. Schiller.—The life of Schiller; *Wallenstein* and other selections. *Three times a week; second semester.* Professor Lessing

19a–19b. Goethe's Faust.—The Faust legend and early Faust books and plays; the genesis of Goethe's *Faust*; reading of both parts. *Twice a week; both semesters.* Professor Goebel

[39a–39b. Goethe–Schiller.—Interpretation of Goethe's poems. Goethe's *Tasso* and Schiller's *Ueber naive und sentimentalische Dichtung. Twice a week; both semesters.* (Not given, 1917–18.) Professor Goebel]

26a. German Literature to the End of the Reformation.—*Three times a week; first semester.* Professor Lessing

26b. German Literature after the Reformation.—*Three times a week; second semester.* Professor Lessing

27. Lessing.—The life of Lessing; *Nathan der Weise, Emilia Gallotti* and other selections. *Three times a week; first semester.* Professor Lessing

29. Advanced Prose Composition.—Themes on Germany and German life, based on suitable reading, discussed in German. *Three times a week; both semesters.* Dr. Nordmeyer

31. Middle High German.—*Twice a week; first semester.* Professor Goebel

32. History of Germanic Civilization.—*Three times a week; first semester.* Assistant Professor Brooks

The Scandinavian Languages

Preparation for major graduate work in the Scandinavian languages or literature must include a good reading knowledge of one of the Scandinavian languages and systematic work in the undergraduate courses in Scandinavian. Any graduate student in language may, however, be admitted to the purely philological courses.

Courses for Graduates

101. Old Norse.—Reading of the *Prose Edda. Twice a week; both semesters. One unit.* Associate Professor Flom

[103. Old Swedish.—Noreen's *Altschwedische Grammatik* and *Lesebuch. Twice a week; second semester. One unit.* (Not given, 1917–18.) Associate Professor Flom]

110. Advanced Old Norse.—Lays of the *Elder Edda* and selections from the *Speculum Regale* (*Konungs Skuggsjá*). *Twice a week; both semesters. One unit.* Associate Professor Flom

[140. Early Scandinavian Paleography.—(The work is based on the facsimiles and photographs of manuscripts in the Scandinavian Collection of the University library.) *Twice a week; second semester. One unit.* (Not given, 1917–18.) Associate Professor Flom]

150. Research.—Special problems in Scandinavian philology or literature. *Twice a week; first semester. One to two units.* Associate Professor Flom

Courses for Graduates and Advanced Undergraduates

14. History of Old Norse Literature.—The mythical lays, the court poetry, the sagas, the ballads. *Twice a week; first semester.* Associate Professor Flom

[16. Introduction to the History of Early Scandinavian Culture.—The civilization of Scandinavia from the Stone Age down to the close of the Viking Age, 1000 A. D. *Twice a week; second semester.* (Not given, 1917–18.) Associate Professor Flom]

GREEK

(See Classics.)

HISTORY

Graduate work in history requires two years of college work in this subject, or sixteen semester hours, which should ordinarily include introductory courses in European and American history. Linguistic preparation is important especially in French and German. For medieval history some knowledge of Latin is essential, and Spanish is useful for certain fields of American history.

Advanced courses in history at the University of Illinois are of three kinds: (1) Courses for information and guidance in general reading. (2) Instruction in methodology, historiography, and bibliography. A part of this work (in course 103) is required of all graduate students in history during their first year. (3) Seminar courses for the study of special fields with a view primarily to training in the methods of historical criticism and research.

Illinois Historical Survey.—Historical students have an opportunity to pursue research in western history in connection with the Illinois Historical Survey, which is an organization for the purpose of carrying on systematic studies in the history of Illinois.

Attention is also called to the fact that the University of Illinois has for some time cooperated with the Trustees of the State Historical Library in the gathering and editing of archive material. As a result of this relation instructors and graduate students in the department have contributed from time to time to the publications of the Library and have been given useful training in the study of manuscript as well as printed material.

Higher Degrees in History: The following statement regarding the specific requirements for higher degrees in history is subject to the general requirements of the Graduate School.

Master of Arts

In addition to meeting the general tests in the specific courses taken, each candidate is required to pass a general oral examination, and written examinations in two of the following fields: ancient history; medieval history of continental Europe; modern history of continental Europe; English history; American history. Candidates for this degree are expected to have a general knowledge of historical bibliography and methodology (see course 103).

Doctor of Philosophy

Major Requirements.—A candidate who selects history as his major subject may offer himself for examination in any four of the fields indicated below, stating also the particular field among these four in which he wishes to specialize and in which his thesis is to be written:

1. Ancient history. 2. Medieval history and institutions of continental Europe, to the close of the thirteenth century. 3. Continental Europe from 1300 to 1648. 4. Continental Europe and its dependencies since 1648 (except as in-

cluded in 5 and 6). 5. The history of England and its dependencies (not including America before 1783). 6. American history (except as included in 5, and with primary reference to the United States). This enumeration of fields is not to be regarded as excluding the possibility of accepting others as may be determined by the department in individual cases.

Minor Subjects.—A candidate for the doctorate in history may select as his first minor one of the divisions of the field of history listed above which is not offered as a part of his major. He should preferably, however, select his minors from subjects offered by other departments. The following list of suitable minors is intended to be suggestive rather than exhaustive or compulsory.

I. In Political Science.—(Any two acceptable for a first minor; any one, for a second minor): 1. International law and diplomacy. 2. Modern government. 3. Municipal government. 4. Constitutional and administrative law and jurisprudence. 5. Political theory.

II. In Economics and Sociology.—Any two acceptable for a first minor; any one, for a second minor: 1. Economic history. 2. Economic theory. 3. Public and private finance. 4. Social reform. 5. Principles of sociology.

III. In Philosophy and Education.—(Any two acceptable for a first minor; any one, for a second minor): 1. History of ancient and medieval philosophy. 2. History of modern philosophy. 3. History of education.

IV. In Literature.—Some division of the history of literature which may be either comparative literature of a limited period or the literature of a particular country for a more extended period as may be agreed on in each case.

Courses for Graduates

101. Seminar in American History.—Bibliography; practise in the solution of typical problems which will be chosen this year with special reference to the international relations of the United States; reports on the progress of individual investigations by instructors and students. *Two hours, once a week; both semesters. One to two units.* Professor Greene and others

In connection with this course, advice and direction in research are offered in various fields as follows:

A. American history before 1815. Professor Greene

B. American history since 1815. Assistant Professor Robertson, Dr. Cole

C. The history of the west. Professor Alvord, Dr. Pease

D. American church history. Professor Greene

E. Latin-American history. Assistant Professor Robertson

102. Studies in English History.—Church and state in the medieval and early modern period; examination of documentary material. *Arrange hours; both semesters. One unit.* Professor Larson

103. Historiography and Historical Method.—The technique of historical investigation. Required of all candidates for an advanced degree in history who do not present evidence of similar training elsewhere. *Twice a week; first semester. One-half unit.* Dr. Cole

104. Seminar in English and Continental European History.—European expansion. Bibliography, historiography, and selected problems; reports. *Two hours, once a week; both semesters. One to two units.*
Professor Larson, Professor Lybyer, and Dr. Jones

In connection with this course, advice and direction in research in various fields are offered as follows:

A. Medieval history. Professor Larson
B. Modern history of continental Europe. Professor Lybyer
C. English history. Professor Larson
D. Renaissance and Reformation. Dr. Jones
E. Asiatic Relations. Professor Greene, Professor Lybyer

105. Studies in the History of the West.—The special subject for 1917–18 will be: French Colonization of the Mississippi Valley. *Once a week; both semesters. One unit.* Professor Alvord

111. Spanish-American Relations.—The relations of the Latin-American States with Europe and the United States; the Monroe Doctrine; the development of international trade, etc. *Once a week; both semesters. One-half to one unit.*
Assistant Professor Robertson

112. Studies in American Religious History.—Questions of Church and State. *Twice a week; second semester. One unit.* Professor Greene

114. Studies in American Constitutional History.—Colonial institutions on the eve of the Revolution; transition from provincial to republican government; genesis of the Federal Constitution; selected topics in the development of the Constitution since 1789. *Twice a week; both semesters.* Professor Greene

150. Research in Oriental History.—*Both semesters. One unit.*
Professor Olmstead

Courses for Graduates and Advanced Undergraduates

4a–4b. Constitutional History of England.—Institutional origins; modern constitutional practise. *Three times a week; both semesters.* Professor Larson

[9a–9b. European Society in the Era of the Renaissance and the Reformation.—The transition from medieval to modern ideals. *Twice a week; both semesters.* (Not given, 1917–18.) Dr. Jones]

11. Special Topics in Ancient History.—Methods of research in Greek and Roman history. *Three times a week; second semester.* Professor Oldfather

[13. The American Revolution, 1760–1783.—Colonial institutions on the eve of the Revolution; the controversy with the Mother Country; war and diplomacy; transition from provincial to republican institutions. *Three times a week; first semester.* (Not given, 1917–18.) Professor Greene]

15. The Civil War and the Reconstruction.—The ante-bellum South and its destruction, 1844–1870. The civil war in the light of the forces which tended to hasten or obstruct the clash of arms. *Three times a week; second semester.*
Dr. Cole

16. The History of the Exploration and Colonization of the West.—The Mississippi Valley from the beginning of the Spanish explorations to the close

of the War of 1812. The development of the Mississippi Valley since 1815 and the progress of westward expansion to the Pacific. *Twice a week; both semesters.* Professor ALVORD

19. FRANCE IN THE FEUDAL AND LATER MIDDLE AGES.—*Twice a week; second semester.* (A reading knowledge of French is desirable.) Dr. JONES

[20a. RECENT EUROPEAN HISTORY, 1848–1891.—The period of national consolidation and world-wide expansion. *Three times a week; first semester.* (Not given, 1917–18.) Professor LYBYER]

[20b. RECENT EUROPEAN HISTORY, 1891 TO DATE.—The formation of alliances, the Balkan wars, and the Great War. *Three times a week; second semester.* (Not given, 1917–18.) Professor LYBYER]

21. THE RECENT HISTORY OF THE UNITED STATES.—Introduction to contemporary American politics. *Three times a week; first semester.* Assistant Professor ROBERTSON

23. ENGLAND IN THE SEVENTEENTH CENTURY WITH SPECIAL REFERENCE TO THE PURITAN REVOLUTION.—The influence of Puritanism on the institutions and ideas of England and America. *Twice a week; second semester.* Dr. PEASE

24. EUROPEAN CONSOLIDATION AND COLONIAL EXPANSION, 1648–1789.—*Three times a week; first semester.* Professor LYBYER

25. THE FRENCH REVOLUTION, NAPOLEON, AND THE EUROPEAN REACTION, 1789–1848.—*Three times a week; second semester.* Professor LYBYER

(Courses 24–25 and 20a–20b will ordinarily be given in alternate years.)

26. HISTORY OF THE LATIN-AMERICAN COLONIES.—The political, economic, social, and intellectual life of Spain during the period of discovery. The exploration, settlement, and civilization of Spanish America and the Philippines. *Three times a week; first semester.* Assistant Professor ROBERTSON

27. HISTORY OF LATIN-AMERICA FROM THE WAR OF INDEPENDENCE TO THE PRESENT TIME.—The national history of the leading Latin-American states with special attention to political parties, existing governments and relations with Europe and the United States. The old regime in Texas, Mexico, and California. *Three times a week; second semester.* Assistant Professor ROBERTSON

29. THE FAR EAST.—The contact of Western nations with the Far East from the Portuguese establishments of the sixteenth century to the present time, with special reference to China and Japan. *Twice a week; second semester.* Professor GREENE

[30. THE OTTOMAN EMPIRE AND THE QUESTION OF THE NEAR EAST.—The rise and greatness, and the beginning of the decline, of the Turkish power, 1300 to 1792. Turkey since 1792, with special attention to internal conditions and international relations. *Twice a week; both semesters.* (Not given, 1917–18.) Professor LYBYER]

31a–31b. THE MOHAMMEDAN WORLD.—Mohammed, the Saracen Empire, and the Moslem civilization, before the crusades. The history and culture, since the first crusade, of the Mohammedan peoples in Europe, Africa, and Asia, except the Ottoman Turks. *Twice a week; both semesters.* Professor LYBYER

40. THE BEGINNINGS OF THE BRITISH EMPIRE.—Conditions that led to English expansion; the history of the empire; imperial institutions. *Twice a week; first semester.* Professor LARSON

52. East and West in Ancient Times.—History of Persia, Parthia, and the Sassanids, to the Moslem conquest; origins of the Eastern questions; interrelation of East and West. *Three times a week; second semester.* Professor Olmstead

53. Assyrian History.—Sources, political thought, government of dependencies, parallels to more modern imperial states, and economic life of the Assyrian Empire. *Three times a week; first semester.* Professor Olmstead

HORTICULTURE

At least two years of collegiate work in horticulture and allied subjects and specific preparation for the chosen topics are required for entrance on major work in this department.

Courses for Graduates

103. Olericulture.—Special problems in vegetables. *Both semesters. One to two units.* Professor Blair, Professor Lloyd

108. Pomology.—Special problems in small fruits and orchard fruits. *Both semesters. One to two units.* Professor Blair, Professor Crandall, Professor Lloyd, Assistant Professor Pickett

115. Floriculture.—The horticultural status of flowering plants, or special problems in the culture of greenhouse plants. *Both semesters. One to two units.* Assistant Professor Dorner

116. Plant Nutrition.—Special problems. *Both semesters. Three-fourths to one-and one-fourth units.* Dr. Muncie

Courses for Graduates and Advanced Undergraduates

8. Orcharding.—Pomaceous and drupaceous or stone fruits. *Five times a week first semester.* Assistant Professor Bailey

12. Evolution of Horticultural Plants.—History, botanical classification, and geographical distribution of cultivated plants; modification under culture; variation. *Three times a week; first semester.* Professor Crandall

18. Experimental Horticulture.—Methods and difficulties; planning of experiments; recording and interpretation of results. (For advanced students preparing for experiment-station work.) *Five times a week; second semester.* Professor Blair, Assistant Professor Pickett

22a–22b. Special Investigation and Thesis.—*Five to ten hours a week; both semesters.*

43. Nutrition of Greenhouse Crops.—Soils and fertilizers; moisture and carbon-dioxide content of the air; temperature as related to greenhouse crops; application of fertilizers, watering, and temperature and humidity regulation. *Three times a week; first semester.* Dr. Muncie, Dr. Englis

44. Pomology Seminar.—Assigned topics; review of books, current technical journals, and other publications. For seniors and graduates specializing in pomology. *Once a week; both semesters.* Assistant Professor Pickett, Assistant Professor Bailey

45a–45b. Plant Nutrition.—Organic compounds in plants and their significance in plant nutrition, with special reference to agricultural crops. Methods of analysis and investigation. *Five times a week; both semesters.* Dr. Muncie, Dr. Englis

46. Marketing Horticultural Products.—Fruits and vegetables. For seniors and graduates specializing in horticulture. *First semester; two credits.*
Professor Lloyd

HOUSEHOLD SCIENCE

This department offers graduate work along two lines, one dealing with the applications of the biological and physical sciences to the problems of food and nutrition; the other with the economic problems of the household. In either case the student must offer a minimum of ten hours' work with food, eight with textiles and clothing, five with the house, eight of chemistry, eight of biological science, and three in the principles of economics. In addition each student must offer five additional hours in economics or a second year of chemistry, including quantitative and organic chemistry, according to the line of specialization.

Courses of Graduates

101. Home Economics.—Industrial, educational, and sociological aspects. *Twice a week; first semester. One unit.* Professor Bevier

102. Special Investigations.—Application of the principles of bacteriology, chemistry, and physiology to the ordinary processes used in the preparation of food; nutrition. *Twice a week; both semesters. One unit.*
Professor Bevier, Assistant Professor Wheeler

103. Seminar.—Recent advances in nutrition. *Once a week; second semester. One-half unit.* Assistant Professor Wheeler

104. Economic Problems of the Family Group.—The economic phases of selected problems of the household. *Twice a week; both semesters. One unit.*
Dr. Perry

Courses for Graduates and Advanced Undergraduates

4. Food and Nutrition.—Application of the principles of pure science to the problems of food and nutrition. *Five times a week; first semester.*
Assistant Professor Wheeler

15. Economics of the Family Group.—The economic relations of the family as a whole and as individuals. Retail market; sources of income, and social and industrial conditions affecting them; child labor; economic position of women. *Three times a week; first or second semester. One-half unit.* Dr. Perry

20. Infant Nutrition.—*Twice a week; second semester.*
Assistant Professor Wheeler

28. Organization of the Household.—Factors determining form and functions of the household; division of labor; use of machinery; domestic service; retail markets; scientific management; cooperative housekeeping. *Three times a week; second semester.* Dr. Perry

MATHEMATICS

Students entering on graduate study with a major in mathematics must have had twenty-five semester hours of undergraduate work in mathematics, including a year's course in calculus and a course in theory of equations, or in differential equations. They should be able to read German and French.

Candidates for a doctor's degree taking a first minor in mathematics are expected to have completed a course in calculus and are required to take two one-year courses beyond the calculus; candidates for a doctor's degree taking a second minor are required to complete at least one course throughout a year beyond the calculus.

Courses for Graduates

100. SEMINAR.—*Three times a week; both semesters. One to two units.* Professor TOWNSEND, Professor MILLER, Professor RIETZ, Associate Professor SHAW, Assistant Professor SISAM, Assistant Professor EMCH, Assistant Professor CARMICHAEL, Assistant Professor CRATHORNE.

[101. FUNCTIONS OF REAL VARIABLES.—*Three times a week; both semesters. One unit.* (Not given, 1917–18.) Professor TOWNSEND]

102. FUNCTIONS OF A COMPLEX VARIABLE.—*Three times a week; both semesters. One unit.* Professor TOWNSEND

[104. EXPANSIONS IN FUNDAMENTAL FUNCTIONS.—Integral equations; expansion of arbitrary functions in terms of the characteristic functions of a given nucleus. *Three times a week; both semesters. One unit.* (Not given, 1917–18.) Associate Professor SHAW]

[105. CALCULUS OF VARIATIONS.—Simple and isoperimetric problems. *Three times a week; both semesters. One unit.* (Not given, 1917–18.) Assistant Professor CRATHORNE]

[110. ELLIPTIC FUNCTIONS.—Applications to geometry and mechanics; the elliptic modular functions. *Three times a week; both semesters. One unit.* (Not given, 1917–18.) Assistant Professor CARMICHAEL]

[111. AUTOMORPHIC FUNCTIONS.—The group-theoretic side of the theory; function-theoretic developments and applications. *Three times a week; both semesters. One unit.* (Not given, 1917–18.) Assistant Professor EMCH]

112. THEORY OF LINEAR DIFFERENCE EQUATIONS.—The gamma functions; general existence theorems; expansions in functions defined by difference equations and applications to the theory of functions; transcendentally transcendental functions. *Three times per week; both semesters. One unit.* Assistant Professor CARMICHAEL

[113. THEORY OF LINEAR DIFFERENTIAL EQUATIONS.—Oscillation theorems for ordinary linear equations of the second order in real variables, general existence theorems and functions, theoretic considerations for ordinary linear equations of order in complex variables; general theory of linear partial differential equations. *Three times a week; both semesters. One unit.* (Not given, 1917–18.) Assistant Professor CARMICHAEL]

120. ELEMENTARY THEORY OF GROUPS.—*Three times a week; both semesters. One unit.* Professor MILLER

[121. THEORY OF GROUPS.—*Three times a week; both semesters. One unit.* (Not given, 1917–18.) Professor MILLER]

122. MODERN ALGEBRA.—Theory of matrices; system of linear equations; bilinear and quadratic forms; properties of polynomials; algebraic invariants; elementary divisors. *Three times a week; both semesters. One unit.* Dr. KEMPNER

[124. THEORY OF NUMBERS.—*Three times a week; both semesters. One unit.* (Not given, 1917–18.) Dr. WAHLIN]

129. Theory of Statistics.—Methods of statistical investigation; application to problems in economics, sociology, and biology. *Three times a week; both semesters. One unit.* Professor Rietz

[130. Invariants and Higher Plane Curves.—Curves of the third and fourth order. *Three times a week; both semesters. One unit.* (Not given, 1917–18.) Assistant Professor Sisam]

131. Algebraic Surfaces.—The application of homogenous coordinates and the theory of invariants to geometry of three dimensions; theory of surfaces; surfaces of the third and fourth order. *Three times a week; both semesters. One unit.* Assistant Professor Sisam

132. Projective Geometry.—Axiomatic foundations, cross ratio, projective pencils and ranges. Application to mechanics. *Three times a week; both semesters.* Professor Emch

[135. Differential Geometry.—Applications of the calculus to the theory of curves and surfaces based primarily in the use of Cartesian coordinates; relation of the theory of surfaces to the theory of invariants of a pair of quadratic differential forms. *Three times a week; both semesters. One unit.* (Not given, 1917–18.) Assistant Professor Sisam]

[141. Vector Methods.—*Three times a week; both semesters. One unit.* (Not given, 1917–18.) Associate Professor Shaw]

142. General Algebra.—*Three times a week; both semesters. One unit.* Associate Professor Shaw

Courses for Graduates and Advanced Undergraduates

*7, 9. Differential and Integral Calculus.—*Five times a week; first semester; three times a week, second semester.* Professor Townsend, Professor Rietz, Associate Professor Shaw, and others.

*8. Differential and Integral Calculus.—This course may be counted for graduate credit by students whose major is chemistry. *Five times a week; first semester.* Professor Miller

10. Theory of Equations and Determinants.—*Three times a week; first semester.* Professor Miller

16–17. Differential Equations and Advanced Calculus.—Ordinary and partial differential equations; special topics of calculus not ordinarily included in a first course, particularly those of value in the applications of mathematics. *Three times a week; both semesters.* Professor Townsend

19. Solid Analytical Geometry.—*Three times a week; second semester.* Assistant Professor Sisam

21. Method of Least Squares.—*Twice a week; first semester.* Professor Stebbins

[30–31. Actuarial Theory.—Life contingencies; construction of life tables, and of monetary tables; valuation of policies to meet statutory requirements; theory of risk; distribution of surplus; preparation of annual reports; inheritance

*Open as a minor to students making a major in chemistry.

taxes; old age pensions; workmen's compensation; investment of funds of an insurance company. *Three times a week; both semesters.* (Not given, 1917–18.)
Professor RIETZ]

[32. HISTORY OF MATHEMATICS.—*Twice a week; second semester.* (Not given, 1917–18.) Dr. LYTLE]

40. FUNDAMENTAL CONCEPTS OF MATHEMATICS.—Development of the number concept; concepts of unity; aggregate, order and correspondence; irrationals and limits, transcendence of *e* and *n;* parallel axiom and non-euclidian geometries; ruler and compass constructions; function; logic of mathematics. *Twice a week; second semester.* Dr. LYTLE

MECHANICAL ENGINEERING

The prerequisite for graduate work in mechanical engineering is the equivalent of the undergraduate course required for the degree of Bachelor of Science in mechanical engineering in the branches of the subject in which registration is desired.

Courses for Graduates

106. HEAT MOTORS.—The internal combustion motor; the steam turbine; refrigeration. *Twice a week; second semester. One unit.* Professor GOODENOUGH

107. THERMODYNAMICS.—Thermodynamics and the solution of engineering problems. *Twice a week; first semester. One unit.* Professor GOODENOUGH

109. MACHINE DESIGN.—Rational design; mechanics of materials. Individual problems. *Twice a week; either semester. One unit.* Professor LEUTWILER

112. LABORATORY INVESTIGATIONS.—Combustion of fuels, boiler economy, steam engines and turbines, and similar subjects. *Three times a week; both semesters. One and one-half units.* Professor RICHARDS and associates

114. DYNAMICS OF MACHINERY.—Advanced problems; whirling and vibration of shafts; theory of governors; fly wheels; force and mass reduction; stresses in rotating masses. *Twice a week; both semesters. One unit.*
Professor GOODENOUGH

Courses for Graduates and Advanced Undergraduates

The following are accepted as minor courses for students who are not candidates for advanced degrees in mechanical engineering:

12. THERMODYNAMICS.—*Five times a week; second semester.*
Professor GOODENOUGH

15. GAS POWER ENGINEERING.—Internal combustion engines; liquid and gaseous fuels and their combustion; gas producers. *Three times a week; first semester.* Professor RICHARDS

26. HEATING AND VENTILATION.—The theory and the application of the principles of heating and ventilation to modern practise. *Three times a week; second semester.* Assistant Professor WILLARD

30. MECHANICS OF MACHINERY.—Mechanisms and mechanical movements; cams, gears, valve gears, and quick-return motions; graphical constructions for displacement, velocity, and acceleration; kinetics of the steam engine mechanism and similar mechanisms. *Five times a week; second semester.* Mr. DENT

32. Power Transmission.—Power transmission by means of shafting, belts, ropes, cables, water, air, gas, and steam; the measurement and storage of power. *Three times a week; second semester.* Professor Richards

33. Aeronautic Engineering.—The history and development of aeronautic science, with a critical analysis of the design of air craft. *Three times a week; first semester.* Assistant Professor Fales

34. Aeronautic Engineering.—A continuation of course 33. *Twice a week; second semester.* Assistant Professor Fales

43. Engineering Design.—Theory of machine design with application. *Five times a week; first semester.* Professor Leutwiler

44. Engineering Design.—Correct design and commercial application of special tools, fixtures, jigs, dies, and gauges used in modern high production manufacturing. *Twice a week; second semester.* Professor Leutwiler

52. Power Plant Design.—Study and design of some form of steam power plant. *Three times a week; second semester.* Professor Leutwiler

65. Power Laboratory.—Experiments on engines, turbines, gas engines, pumps, boilers, injectors, air compressors, hoisting appliances, heating apparatus, and refrigerating machines. *Three times a week; first semester.*

66. Power Laboratory.—Special research work in the mechanical engineering laboratory. *Twice a week; second semester.*

MECHANICS, THEORETICAL AND APPLIED

The prerequisite for the courses for graduates in theoretical and applied mechanics is the equivalent of the undergraduate courses in theoretical and applied mechanics and in allied engineering subjects required for the degree of Bachelor of Science in engineering.

Courses for Graduates

101. Analytical Mechanics.—*Twice a week; first semester. One unit.* Professor Moore

102. Resistance of Materials.—Properties of materials used in engineering construction and the methods of determining these properties. *Twice a week; second semester. One unit.* Professor Moore

103. Hydraulics and Hydraulic Engineering.—The laws of hydraulics and their application to engineering problems; hydraulic power and its development; design and investigation. *Twice a week; second semester. One-half to one unit.* Professor Talbot, Professor Moore

104. Experimental Work in Laboratory of Applied Mechanics.—(a) Laboratory investigation in the materials-testing laboratory; (b) experimental work in hydraulic laboratory; the laws of hydraulics; the development of power; hydraulic problems. *Twice a week; both semesters. One-half to two units.* Professor Talbot, Professor Moore

105. Experimental and Analytical Work in Reinforced Concrete.—Reinforced concrete and its action in structures. *Twice a week; both semesters. One and one-half units.* Professor Talbot

Courses for Graduates and Advanced Undergraduates

(These courses are open only for minor credit to students not candidates for a degree in engineering.)

1. ANALYTICAL MECHANICS.—(For students in arts and sciences.) Lamb's *Statics* and Lamb's *Dynamics*. *Three times a week; first semester.* Mr. ENSIGN

2. ANALYTICAL MECHANICS.—(Continuation of course 1.) Lamb's *Dynamics*. *Three times a week; second semester.* Mr. ENSIGN

10. HYDRAULICS.—The pressure and flow of water; its utilization as motive power; observation and measurement of pressure, velocity, and flow; power and efficiency: determination of experimental coefficients. Hoskins' *Hydraulics*. *Laboratory weekly; three times a week; second semester.* Assistant Professor ENGER and others

21. ANALYTICAL MECHANICS.—(Continuation of Theoretical and Applied Mechanics 20.) Kinematics and kinetics. Maurer's *Technical Mechanics*. *Twice a week; first semester.* Mr. BOOMSLITER and others

25. RESISTANCE OF MATERIALS.—(For students in architectural, ceramic, chemical, electrical, and mining engineering.) Merriman's *Mechanics of Materials*. *Four times a week; first semester.* Assistant Professor ENGER and others

26. ANALYTICAL MECHANICS AND HYDRAULICS.—Kinematics, kinetics, and hydraulics; problems; experiments in the hydraulic laboratory. (For students in architectural, electrical, and mining engineering.) Maurer's *Technical Mechanics;* Hoskin's *Text-Book on Hydraulics*. *Laboratory weekly during the last half of semester*. *Four times a week; second semester.* Assistant Professor ENGER and others

METEOROLOGY

(See GEOLOGY)

MINERALOGY

(See GEOLOGY)

MINING ENGINEERING

The prerequisite for graduate work in mining engineering is the equivalent of the undergraduate courses required for the degree of Bachelor of Science in mining in the branches of the subject in which registration is desired.

In addition to the regular University laboratories, the laboratory connected with the investigation of mining conditions in Illinois now being carried on jointly by the Engineering Experiment Station through the Department of Mining Engineering, the State Geological Survey, and the United States Bureau of Mines, is available for graduate instruction.

Courses for Graduates

100. SEMINAR.—*Once a week; both semesters. One unit.* Professor STOEK

101. ADVANCED MINING METHODS.—Coal and ore fields of the United States; methods and economics of mining; utilization, marketing, storage, and transportation of coal and ores. *Twice a week; both semesters. One unit.* Professor STOEK

102. Advanced Preparation of Coal and Ores.—Settling ratios, laws of crushing; sorting vs. sizing; mill and washing problems; flotation. *Twice a week; both semesters. One unit.* Assistant Professor Holbrook

103. History of Miners' Organizations.—*Twice a week; both semesters. One unit.* Professor Stoek

104. Mining Reports.—Law of the apex, the classification of coal and ore lands; conservation of mineral resources; mine examination and report. *Twice a week; both semesters. One unit.* Professor Stoek

105. Welfare Work and Education Among Mine Employees.—The organization and operation of mining institutes, night classes, welfare, mine rescue, and first-aid work. *Twice a week; both semesters. One unit.* Professor Stoek

Courses for Graduates and Advanced Undergraduates

5. Mine Ventilation.—*Three times a week; first semester.* Professor Stoek

9. Preparation of Coal and Ores—*Three times a week; first semester.* Assistant Professor Holbrook

13. Utilization of Fuels.—*Twice a week; second semester.* Assistant Professor Holbrook

19. Ore and Coal Preparation.—*Three times a week; first semester.* Assistant Professor Holbrook

21. Mine Examination and Valuation.—*Twice a week; first semester.* Professor Stoek

MUNICIPAL AND SANITARY ENGINEERING

The prerequisite for graduate work in municipal and sanitary engineering is the equivalent of the undergraduate courses required for the degree of Bachelor of Science in municipal and sanitary engineering in the branches of the subject in which registration is desired.

Courses for Graduates

102. Water Supply Engineering.—Advanced work arranged to suit the requirements of individual classes. *One to three times a week; first or second semester. One unit.* Professor Talbot

103. Sewerage.—General sewerage design and construction; sewerage systems; hydraulics of sewers. *Once or twice a week; second semester. One unit.* Professor Talbot

106. Water Purification, Sewage Disposal, and General Sanitation.—Design, construction, and operation of water purification plants and of sewage disposal works; water filters, sewage tanks, etc.; garbage disposal and general sanitation. *Once a week; second semester. Half unit or more.* Professor Talbot

Courses for Graduates and Advanced Undergraduates

6a–6b. Water Purification, Sewage Disposal, and General Sanitation.—Impurities in water supplies and methods and processes of removal; sewage disposal; purification plants; garbage collection and disposal; sanitary restrictions and regulations and general sanitation. *Three times a week; first semester. Twice a week; second semester.* Professor Talbot, Mr. Babbitt

ORIENTAL LANGUAGES AND LITERATURES

Courses for Graduates and Advanced Undergraduates

1. ELEMENTARY HEBREW.—Grammar and reading. The Book of Genesis. *Three times a week; both semesters.* Professor OLMSTEAD

[10. ELEMENTARY ASSYRIAN.—Grammar, sign lists, and reading. *Three times a week; both semesters.* (Not given, 1917–18.) Professor OLMSTEAD]

PALEONTOLOGY

(See GEOLOGY)

PHILOLOGY

(See CLASSICAL PHILOLOGY, under CLASSICS, COMPARATIVE PHILOLOGY, and ROMANCE PHILOLOGY, under ROMANCE LANGUAGES.)

PHILOSOPHY

Students entering on graduate work in philosophy must have had a general course in the history of philosophy, a course in logic, and a general course in psychology.

Courses for Graduates

103. SEMINAR IN ETHICS.—British ethics from Hobbes to Sidgwick. *Twice a week; both semesters. One unit.* Professor DANIELS

107a–107b–107c. HISTORY OF PHILOSOPHY.—(a) Plato and Aristotle. *Twice a week; both semesters. One unit.*

(b) Descartes, Spinoza, and Leibnitz. *Twice a week; both semesters. One unit*

(c) Kant and Schopenhauer. *Twice a week;* (a) *both semesters. One unit.*

(The subjects in 1917–18 will be determined by the needs of the students registered.) Professor DANIELS

108a–108b–108c. SEMINAR IN CONTEMPORARY PHILOSOPHY.—(a) Idealism. *Twice a week; both semesters. One unit.*

(b) Realism and pragmatism. *Twice a week; both semesters. One unit.*

(c) The philosophy of Bergson. *Twice a week; both semesters. One unit.*

(The subjects in 1917–18 will be determined by the needs of the students registered.) Professor BODE

Courses for Graduates and Advanced Undergraduates

3. HISTORY OF ANCIENT AND MEDIEVAL PHILOSOPHY.—*Three times a week; first semester.* Professor DANIELS

4. HISTORY OF MODERN PHILOSOPHY.—*Three times a week; second semester.* Dr. SHEPHERD

7. ETHICS.—The beginning and growth of morality; ethical theory; social and economic problems of the present. *Three times a week; second semester.* Professor DANIELS

11. PHILOSOPHY OF RELIGION.—Among the topics considered are: God; revelation; inspiration; dogma; prayer; faith; immortality; the problem of evil; the relation of morality and religion. *Twice a week; second semester.* Professor DANIELS

15. British Philosophers of the Eighteenth Century.—Locke, Berkeley, and Hume. *Three times a week; first semester.* Professor Bode

16. Philosophy of Pragmatism.—*Three times a week; second semester.* Professor Bode

18. Philosophers of the Nineteenth Century.—Philosophical tendencies in materialism, naturalism, idealism, and pragmatism. *Three times a week; first semester.* Dr. Shepherd

19. Rationalism and Religion in the Eighteenth and Nineteenth Centuries.—*Three times a week; first semester.* Dr. Shepherd

PHYSICS

The prerequisite for graduate work in physics is a college course in general physics with a year's laboratory course in introductory physical measurements. The student who is to do major work in physics should also have had additional courses in physics or teaching experience, unless the training in his minor subjects, mathematics or chemistry, has been strong and complete. He should also have a knowledge of French and German sufficient to use references in these languages. The courses named below are those open for candidates for the master's or doctor's degree. A large part of the last year's work of the candidate for the doctor's degree is investigational, along either the experimental or the theoretical side of physics. In addition to these major graduate courses, the courses in elementary dynamics, heat, light, electrical measurements, and introductory electrical theory are arranged with certain additions for graduate credit. The intermediate courses on electricity and magnetism, heat, and light (Physics 15, 16, 17), may be offered with certain additions by candidates for the master's degree and then generally only as minors.

Courses for Graduates

104a–104b. Selected Problems in Electrical Measurements.—(a) Measurement of very high and very low resistances; aperiodic and ballistic galvanometers of the magnetic needle and suspended coil types; damping factor and critical damping resistance; electric current and quantity; comparison of capacities; absolute determination of capacity; the Dolezalek quadrant electrometer; dielectric constants; the measurement of v and e/m for cathode rays; positive electricity; the potentiometer. (b) Refined methods of measuring properties of iron; plotting of hysteresis curves, and the determination of hysteresis losses; etc. *Two times a week of three hours each; both semesters. Three-fourths unit.* (Course 104a is recommended for graduate students in chemistry.) Associate Professor Knipp

121. Recent Advances in Physics and the Electron Theory.—The universal occurrence of electrons; properties of the electron, and of the gaseous ion; determination of e/m and v of the electron, and of the ion; use of positive rays in gas analysis; color effects of electrons, of ions, and of retrograde rays in residual hydrogen, helium, neon, and argon; determination of the elementary charge of the electron by means of the fog method, by radioactivity. *Two hours every two weeks; second semester. One-fourth unit.* Associate Professor Knipp

123. SOUND.—Wave motion; forced vibrations; velocity and energy relations of sound waves; resonance; vibrations of strings and organ pipes. *Three times a week; second semester. Three-fourths unit.* Associate Professor WATSON

124. CONDUCTION OF ELECTRICITY THROUGH GASES.—Experiments relating to discharge phenomena. In the second semester an original problem is assigned. *Three times a week; both semesters. One to two units.* Associate Professor KNIPP

126. PHYSICS COLLOQUIUM.—Weekly meetings of the instructors and advanced students of the department for the presentation and discussion of papers on current problems in physics. Attendance is expected of all the graduate students. *Once a week; both semesters. No credit.*

127. PROBLEMS OF PRESENT THEORETICAL INVESTIGATIONS IN PHYSICS.—The fundamental laws of nature, the principle of least action, equipartition of energy, entropy and probability, laws of radiation and the energy quantum. *Once in two weeks; both semesters. One-half unit.* Associate Professor KUNZ

131. INVESTIGATION OF SPECIAL PROBLEMS.—*Two to four times a week; both semesters. One to two units.* Professor CARMAN, Associate Professors KNIPP, WATSON, KUNZ, Assistant Professor SCHULZ, Dr. WILLIAMS

132. MATHEMATICAL PHYSICS.—Special phases in theoretical physics.

132a. DYNAMICS.—Newton's equations; general methods of integration, potential-theory; potential of the ellipsoid; application to celestial mechanics; the principles of least constraint; of virtual work, of D'Alembert, of Hamilton. Special problems of the hydrodynamics and of elasticity. *Three times a week; both semesters. One unit.* (Either 132a or 132e will be given in 1917–18, after consultation with students.) Associate Professor KUNZ

[132b. ELECTRODYNAMICS.—The potential theory applied to electrical and magnetic polarization; spherical harmonics, images and inversion, conjugate functions, elliptic coordinates and integrals, magnetic actions of currents, determination of coefficients of capacity, self and mutual induction, absolute measurements, Maxwell's theory with some applications in optics. *Four times a week; both semesters. One unit.* (Not given, 1917–18.) Associate Professor KUNZ]

[132c. THERMODYNAMICS AND KINETIC THEORY OF MATTER.—Chemical equilibrium; the Nernst theorem; Carnot's cycle; the thermodynamic potentials and the derived functions; Maxwell's theory of the distribution of velocities in a gas; Boltzman's H theory; the theory of radiation, especially Planck's theory of quanta. *Both semesters. One unit.* (Not given, 1917–18.) Associate Professor KUNZ]

132d. THEORY OF ELECTRICAL OSCILLATIONS; SPHERICAL AND CYLINDRICAL HARMONICS.—Diffusion of electricity, heat, and matter; transatlantic cable; electrical oscillations along wires; long-distance telephony; vibrations from a Hertz oscillator; from the antenna; propagation of electrical waves over the surface of the earth and their absorption; reflection of electrical waves from planes, cylinders, and spheres; diffraction of waves; spherical and cylindrical harmonics. *Two times a week; both semesters. One unit.* Associate Professor KUNZ

132e. THEORY OF ELASTICITY.—Special problems of oscillations, involving the use of homogeneous integral equations. Vibrations of membranes, bars, and plates. General theory of elasticity; present theoretical problems in this field.

Four times a week; both semesters. One unit. (Either 132a or 132e will be given in 1917–18, after consultation with students.) Associate Professor KUNZ

133. SEMINAR.—*Three or five times a week; both semesters. One to three units.* Professor CARMAN, Associate Professors KNIPP, WATSON, KUNZ, Assistant Professor SCHULZ

Courses for Graduates and Advanced Undergraduates

4a–4b. ELECTRICAL AND MAGNETIC MEASUREMENTS.—(Special section for graduate students of chemistry during the first semester.) *Twice a week; both semesters.* Associate Professor KNIPP

14a. INTRODUCTION TO THEORETICAL PHYSICS.—Dynamics. Motion, mass, and force; problems from pure and applied physics. *Three times a week; first semester.* Professor CARMAN

*15. ELECTRICITY AND MAGNETISM.—(Recommended to students in non-technical courses who wish a knowledge of electricity and magnetism beyond the course in general physics.) *Two recitations or lectures and one three-hour laboratory exercise weekly; first semester.* Associate Professor KNIPP

*16. HEAT.—Fundamental heat phenomena, the mechanical theory of heat, and elementary thermodynamics. Thermometry, calorimetry, vapor pressure, expansion of bodies, transmission of heat, mechanical equivalent. *Three times a week; first semester.* Associate Professor WATSON

*17. LIGHT.—Reflection, refraction, interference, diffraction, and polarization; telescopes, microscopes, refractometers, prism and grating spectroscopes, and interferometers. *Three times a week; second semester.* Assistant Professor SCHULZ

20. LIGHT.—Special phenomena; modern theories; readings in Drude, Wood, and Preston. *Twice a week; first semester.* Assistant Professor SCHULZ

22. ADVANCED LIGHT MEASUREMENTS.—Wave length determinations with gratings, echelons, and interferometers; spectroscopic work; Zeeman effect; polarimetric analysis; determination of resolving power of instruments; photometry and spectrophotometry. *Twice a week; first semester.* Assistant Professor SCHULZ

23. SOUND.—Origin, propagation, velocity, and interference of sound; vibration of strings, rods, and gas columns; physical theory of music and speech. *Three times a week; second semester.* Associate Professor WATSON

24. PROPERTIES OF MATTER.—Weight; mass; gravitation; elasticity; viscosity; surface tension; diffusion. Measurements including the use of the dividing engine, chronograph, etc. *Two times a week; second semester.* Dr. WILLIAMS

27. FUNDAMENTAL PHYSICAL MEASUREMENTS.—An advanced laboratory course in measurements of length, mass, time and of determinations of gravitation, elasticity, surface tension, viscosity, etc. *Once a week; second semester. One unit.*

30. INTRODUCTION TO THEORETICAL ELECTRICITY.—Electrical and magnetic phenomena discussed with calculus methods. (For advanced students in physics, chemistry, mathematics, and engineering.) *Three times a week; second semester.* Associate Professor KNIPP

*These courses may be taken for a minor credit or as *first* year major credit only.

31a–31b. Special Problems in Advanced Physical Measurements.—*Two or three times a week; both semesters.* Professor Carman, Associate Professors Knipp and Watson, Assistant Professor Schulz, Dr. Williams

PHYSIOGRAPHY

(See Geology)

PHYSIOLOGY

The prerequisites for graduate work in physiology are three semester hours in histology, five semester hours in chemistry, and five in botany or zoology.

Courses for Graduates

100. Physiology of Secretion and Excretion.—The secretions of mammals; the factors controlling the flow of these juices. *Three times a week; first semester. Three-fourths unit.* Assistant Professor Burge

101. Journal Club.—Review of literature and discussion of investigation carried on in the department. *Once a week; both semesters. One-fourth unit.* Members of the staff

102. Research.—*Three times a week; both semesters. One or two units.* Members of the staff

Courses for Graduates and Advanced Undergraduates

1. Histology.—The fundamental mammalian tissues. *Three times a week; first semester.* Assistant Professor Burge

2. Experimental Physiology.—Nerve; muscle; circulation; secretion; digestion; metabolism. *Five times a week; second semester.* Assistant Professor Burge, Miss Neill

3. Experimental Physiology.—Nerve and muscle. *Twice a week; first semester.* Assistant Professor Burge

5. Physiology of Nutrition.—Utilization of food material by the body in health under various conditions and in disease. *Twice a week; second semester.* Assistant Professor Burge

6. Physiology of the Nervous System.—Functions of the principal motor and sensory tracts and of the autonomic nervous system of the mammal. *Three times a week; first semester.* Assistant Professor Burge

7. Investigation.—*Twice a week; both semesters.* Members of the staff

8. Histology.—Microscopic anatomy of the organs. *Three times a week; second semester.* Assistant Professor Burge

POLITICAL SCIENCE

Graduate work in political science is conducted in the following special fields: (1) Political theory; (2) international law and diplomacy; (3) comparative government; (4) constitutional law, administrative law, and jurisprudence; (5) municipal administration.

To be admitted to take political science as a major subject, the student must have done at least 18 hours of undergraduate work in political science, economics,

and history, not less than nine hours of which must have been in political science. To take political science as a minor he must have had at least nine hours' work in these fields, including six hours in political science.

If a student making political science his major is taking both of his minors in other departments, one of them must be in history, economics, or sociology.

Several courses given in other departments are so closely related to those in political science that graduate students whose major is political science may be permitted on petition to take such courses as part of their major work. Attention is also called to the technical courses given by the department of municipal and sanitary engineering.

Courses for Graduates

101. History of Political Theories.—Political theories of Aristotle, Machiavelli, Hobbes, Locke, Montesquieu, Rousseau, and others; evolution of American political ideas. *Twice a week; first semester. One unit.*
Professor Garner

[102. The Nature of the State.—*Twice a week; first semester. One unit.* (Not given, 1917–18.) Professor Garner]

103. Seminar in Political Science and Public Law.—*Once a week; both semesters.* Members of the department

[104. Municipal Government.—Special attention devoted to the problems of government in metropolitan districts, *e. g.*, the multiplicity of governmental units; overlapping functional activities; state and multistate control within metropolitan areas; proposed remedies such as home rule, consolidation of local governments, and city states. *Twice a week. One unit. Time to be arranged.* (Not given, 1917–18.) Mr. Story]

106. International Law as Applied During the European War.—Questions of war law arising during the present European war, such as the rights and duties of neutrals, contraband, right of search, capture, continuous voyage, transfers of flag, blockade. *Twice a week; second semester. One unit.* Professor Garner

112. Public Administration.—Comparative studies in national and local administration. *Twice a week; first semester. One unit.* Professor Fairlie

113. State Government and Administration.—Position of the states in the American system; organization and functions of state governmental agencies; formation and execution of public policy through state legislation and administration. *Twice a week; second semester. One unit.* Assistant Professor Mathews

Courses for Graduates and Advanced Undergraduates

4. Municipal Government.—*Three times a week; first semester.* Mr. Story

5. Constitutional Law of the United States.—*Three times a week; first semester.* Mr. Cushman

6. International Law.—*Three times a week; first semester.*
Professor Garner

7. American Diplomacy.—*Three times a week; second semester.*
Assistant Professor Mathews

9. Principles of Jurisprudence.—The nature and sources of law; historical development and comparison of Roman law and the English legal system; English

common law in the United States; relation between statutes and judicial decisions; classification of law. *Twice a week; second semester.* Professor FAIRLIE

[10. ADMINISTRATIVE LAW IN THE UNITED STATES.—Administrative organization; separation of powers and delegation of legislative powers; nature and scope of administrative power; administrative procedure and methods of enforcing governmental commands; remedies of the individual against unlawful official action. *Three times a week; second semester.* (Not given, 1917–18.) Mr. CUSHMAN]

11. CONSTITUTIONAL ASPECTS OF SOCIAL AND INDUSTRIAL PROBLEMS.—The police power; constitutional limitations on legislation concerning the public health and safety; the control of public service corporations and combinations of capital and labor, *Three times a week; first semester.* Mr. CUSHMAN

12. NATIONAL ADMINISTRATION IN THE UNITED STATES.—The President and his Cabinet; the executive departments and the administrative services of the national government. *Three times a week; second semester.* Professor FAIRLIE

13. STATE ADMINISTRATION IN THE UNITED STATES.—*Three times a week; first semester.* Assistant Professor MATHEWS

14. POLITICAL PARTIES.—Development of political parties and their organization and influence on the government mainly, in the United States and Great Britain; recent legislation on primaries and nomination methods in this country. *Twice a week; first semester.* Professor FAIRLIE

18. LEGISLATION IN THE UNITED STATES.—Nature of legislative power; representation; legislative organization, procedure and practises; bill drafting; legislative reference bureaus; popular law making; tendencies in legislation. *Three times a week; second semester.* Mr. STORY

21. BRITISH GOVERNMENT.—Political institutions in the United Kingdom and British Possessions. *Three times a week; first semester.* Professor FAIRLIE

22. CONTINENTAL EUROPEAN GOVERNMENT.—The national political systems of France, Germany, Italy, Austria-Hungary, and Switzerland. *Three times a week; second semester.* Professor GARNER

28. PROBLEMS OF CONTEMPORARY POLITICS.—Reorganization of state government; state socialism; immigration; foreign and colonial policies; parliamentary government: direct popular government. *Twice a week; first semester.* Mr. STORY

34. MUNICIPAL PROBLEMS.—Municipal administration in the United States and Europe; municipal organization and relations to the state; municipal ownership and regulation of public utilities; city planning and housing; police and sanitary administration; municipal finances. *Three times a week; second semester.* Professor FAIRLIE

35. LEGAL PROBLEMS OF THE CITY.—Legal status of the city; powers in police regulations, taxation, special assessments, streets, public utilities, and city planning; municipal contracts and liabilities. *Twice a week; second semester.* Mr. CUSHMAN

PSYCHOLOGY

Graduate students who elect psychology as their major subject must have had standard courses, of university grade, both in general psychology and in the psychological laboratory. One general university course is the minimal requirement for graduate students who apply to the department for a minor subject.

Courses for Graduates

103. RESEARCH.—Experimental and historical investigations. *Both semesters. One-half to two units.* Professor BENTLEY, Dr. RUCKMICH, Dr. RAHN

105. SEMINAR.—Current topics in their historical setting. *Once a week, two hours; both semesters. One-half unit.* Professor BENTLEY

Courses for Graduates and Advanced Undergraduates

5–6. COMPARATIVE PSYCHOLOGY.—Mind in the animal forms. *Twice a week; both semesters.* Professor BENTLEY, Dr. RAHN

9. PHYSIOLOGICAL PSYCHOLOGY.—The psychophysical relationships. *Three times a week; second semester.* Dr. RAHN

10. GERMAN READING.—Translation of technical German treatises on psychological subjects. *Once a week; first semester.* Professor BENTLEY

12–13. MINOR PROBLEMS.—Methods suitable to new problems. *Two to five times a week; both semesters.* Professor BENTLEY, Dr. RUCKMICH, Dr. RAHN

14. SOCIAL PSYCHOLOGY.—The social consciousness, its factors and conditions; the psychology of peoples. *Three times a week; first semester.* Dr. RAHN

16. GENETIC PSYCHOLOGY.—Instinctive responses; habits; development of mental functions in the child from birth to maturity. *Twice a week; first semester.* Dr. RUCKMICH

17. THE HISTORY OF PSYCHOLOGY.—*Twice a week; second semester.* Dr. RUCKMICH

20. SYSTEMATIC PSYCHOLOGY.—*Three times a week; second semester.* Professor BENTLEY

21–22. SPECIAL STUDIES.—Individual investigation for advanced students. *Three times a week; both semesters.* Professor BENTLEY, Dr. RUCKMICH, Dr. RAHN

RAILWAY ENGINEERING

The prerequisite for graduate work in railway engineering is the equivalent of the undergraduate courses required for the degree of Bachelor of Science in railway engineering in the branches of the subject in which registration is desired.

Courses for Graduates

102. LOCOMOTIVE DESIGN.—Steam pressure, compounding, superheating, etc. *Once a week; both semesters. One unit.* Assistant Professor SNODGRASS

106. LOCOMOTIVE OPERATION.—Train resistance and locomotive tractive effort; tonnage ratings. *Once a week; both semesters. One unit.* Professor SCHMIDT, Assistant Professor SNODGRASS

108. ELECTRIC RAILWAYS.—Design, selection, and operation of electric railway equipment. *Once a week; both semesters. One unit.* Assistant Professor BUCK

[110. RAILWAY LOCATION.—Effects of the location of a railway on its earning capacity; engineering and economic problems met with in original location; relocation and reduction of grades of existing lines. *Once a week; both semesters. One unit.* (Not given, 1917–18.)]

Courses for Graduates and Advanced Undergraduates

6. LOCOMOTIVES.—*Four times a week; second semester.* Professor SCHMIDT

[33. Economic Theory of Railway Location.—*Four times a week; second semester.* (Not given, 1917-18.)]

64. Electric Railway Practise.—*Three times a week; first semester.*
Assistant Professor Buck

65. Electric Railway Economics.—*Four times a week; second semester.*
Assistant Professor Buck

RHETORIC

(See English)

ROMANCE LANGUAGES AND LITERATURES

Before entering on the study of Romance languages as a major for an advanced degree, the candidate must have had at least (a) three years of college work in French, together with a reading knowledge of Italian or Spanish; or (b) two years of college work in French and the same in Italian or Spanish. In addition a candidate must have had good training in Latin, and must be able to read ordinary German prose.

Before entering on the study of Romance languages as a first or second minor, for an advanced degree, the candidate must have had a total of at least two years of college work in the language desired. He must also be able to read ordinary German prose.

French

Courses for Graduates

[101. Old French Epic Literature.—Reading and interpretation of the greater national and courtly epics; the history of these types of medieval literature. *Twice a week; both semesters. One unit.* (Not given, 1917–18.)
Professor Oliver]

102. Old French Lyric and Prose Literature.—Interpretation of the earlier Old French didactic, chronicle, and lyric writers. The history of these types of medieval literature. *Twice a week; both semesters. One unit.* Professor Oliver

[106. Early French Drama.—Origins of the drama in France, and its development up to the Renaissance. *Twice a week; both semesters. One unit.* (Not given, 1917–18.) Associate Professor Carnahan]

103. Seventeenth Century Prose Writers.—French culture, society, and prose literature of the seventeenth century; great preachers and moralists; Jansenism and Port Royal; formation of the classic ideals. *Once a week; both semesters. One-half unit.* Professor Oliver

[104. Eighteenth Century Prose Writers.—Society, culture, and prose literature of the eighteenth century. The attack on the classic ideals; growth of the revolutionary spirit; first movements towards romanticism. *Once a week; both semesters. One-half unit.* (Not given, 1917–18.) Professor Oliver]

119. Belgian Literature in French since 1880.—*Twice a week; second semester. One unit.* Dr. Gillet

127. French Romanticism.—*Twice a week; both semesters. One unit.*
Associate Professor Carnahan

Courses for Graduates and Advanced Undergraduates

10a–10b. General Survey of French Literature.—*Three times a week; both semesters.* Associate Professor Carnahan

24a–24b. French Drama of the Seventeenth and Eighteenth Centuries.—Corneille, Racine, Moliere, Voltaire, Marivaux, Sedaine, Beaumarchais. *Three times a week; both semesters.* Professor Oliver

[17a–17b. French Drama of the Nineteenth Century.—Hugo, Dumas, Augier, Sardou, Becque, Coppée, Brieux, Lavedan, Hervieu, Rostand. Dramatic criticism. *Twice a week; both semesters.* (Not given, 1917–18.)
Professor McKenzie

45a–45b. French Realism.—Balzac, Flaubert, E. and J. de Goncourt, Daudet, Zola, Maupassant. Lectures; collateral reading. *Twice a week; both semesters.* Dr. Moore

Italian

Courses for Graduates

140. Italian Literature of the Thirteenth and Fourteenth Centuries.—Dante, Petrarch, Boccaccio. *Twice a week; first semester. One unit.*
Professor McKenzie

[143. Italian Literature of the Fifteenth and Sixteenth Centuries.—*Twice a week; first semester. One unit.* (Not given, 1917–18.)
Professor McKenzie]

[146. Modern Italian Literature.—Italian writers of the nineteenth century. *Twice a week; second semester. One unit.* (Not given, 1917–18.)
Professor McKenzie]

Course for Graduates and Advanced Undergraduates

2a–2b. Italian Literature.—Reading; composition; conversation. Introduction to Dante. *Twice a week; both semesters.* Dr. Van Horne

Spanish

Courses for Graduates

132. The Novela of the Golden Age.—Political and social conditions in Spain from 1560 to 1700; the kinds of prose fiction produced in this period; *Don Quixote* and the *Novelas Exemplares* of Cervantes. *Twice a week; both semesters. One unit.* Professor Fitz-Gerald

[133. Origin of the Spanish Novela and of the Comedia.—The development of Spanish prose fiction and of Spanish dramatic art for the period previous to the Golden Age. *Twice a week; both semesters. One unit.* (Not given, 1917–18.)
Professor Fitz-Gerald]

[134. The Spanish Ballad.—Types of the ballad. *Twice a week; both semesters. One unit.* (Not given, 1917–18.) Dr. Seymour]

135. The Modern Novel in Spain.—Development of the modern novel in Spain from the middle of the nineteenth century to the present time. Development of the novel in Spain, France, and Italy. *Twice a week; both semesters. One unit.* Dr. Seymour

Course for Graduates and Advanced Undergraduates

11a–11b. Spanish Drama of the Sixteenth and Seventeenth Centuries.—Dramatists of the classical period; Lope de Vega, Calderon, Tirso de Molina, and Ruiz de Alarcon. *Twice a week; both semesters.* Dr. Seymour

17a–17b. Spanish Drama of the Nineteenth Century.—*Twice a week; both semesters.* Dr. Van Horne

Romance Philology

Courses for Graduates

171. Introduction to Romance Philology.—Historical phonology and morphology of the Romance languages. *Twice a week; both semesters. One unit.* Professor Fitz-Gerald

[175. Old French Phonology and Morphology.—Development of Old French from Vulgar Latin. *Twice a week; both semesters. One unit.* (Not given, 1917–18.)]

179. Old Provencal.—Historical grammar; selected texts. *Once a week; both semesters. One-half unit.* Dr. Moore

[181. Origin and Formation of the Italian Language.—Thirteenth century texts. *Twice a week; second semester. One unit.* (Not given, 1917–18.) Professor McKenzie]

[185. Oldest Monuments of the Spanish Language; Origins of Spanish Poetry.—Historical grammar and paleography; interpretation of texts. *Twice a week; both semesters. One unit.* (Not given, 1917–18.) Professor Fitz-Gerald]

191. Fables and Bestiaries.—History of animal literature, especially the medieval French and Italian collections. *Twice a week; second semester. One unit.* Professor McKenzie

195. Seminar.—Research work in preparation for theses in the field of the Romance languages. *Both semesters. One unit.* Members of the department

SCANDINAVIAN LANGUAGES

(See Germanic Languages.)

SOCIOLOGY

Preparation for graduate work in sociology must include at least the equivalent of twelve semester hours in the social sciences, of which at least three must be in sociology, and three in the principles of economics. The remainder may be in any combination of these two subjects, or of history and political science.

Courses for Graduates

100. Bases of Social Theory.—*Twice a week; first semester. One unit.* Professor Hayes

101. Sociological Method.—Adaptability to sociological investigation of methods described in Pearson's *Grammar of Science*, Wundt's *Methodenlehre, zweite abtheilung*, Seignobos' *La Methode Historique Appliquee aux Sciences Sociales*, Bernheim's *Historische Methode*, Spencer's *Study of Sociology*, and Giddings's *Inductive Sociology. Three times a week; first semester. One unit.* Professor Hayes

102. The Development of Sociology.—*One session, two hours, each week; both semesters. One unit.* Professor Hayes

150. Seminar.—Preparation of theses; detection and statement of problems. *One session of two hours each week; both semesters. One to two units.* Professor Hayes

(Note: One of the three courses last described will be omitted in 1917–18; which one is omitted will depend on the election of students.)

Courses for Graduates and Advanced Undergraduates

2. Social Psychology and Social Control.—Current tendencies in the psychological interpretation of social life; ways in which the sentiments, opinions, and conduct of the members of society are shaped. *Three times a week; second semester.* Mr. Dennis

3. Social Evolution.—The explanation of progressive social change, derived by applying the comparative method to ethnographic and historical materials as to family organization, practical arts, economic wants and institutions, government and law, moral codes, and religions as they have appeared among savages, barbarians, and civilized peoples. *Three times a week; second semester.* Professor Hayes

8. Charities.—The evolution of modern organized philanthropy, public and private; causes and prevention of poverty; organization and management of charitable institutions. *Three times a week; first semester.* Dr. Stevens

9. Criminology.—Nature, causes, and treatment of the criminal; evolution of modern method of criminal procedure and penology; recent experiments and tendencies. *Three times a week; second semester.* Dr. Stevens

10. Problems of Population.—*Three times a week; first semester.* Dr. Stevens

12. Labor Problems.—The same as Economics 12. *Three times a week; both semesters.* Mr. Hoagland

14. Social Statistics.—Social investigation and research. Social and community surveys. The verification of sociological laws and principles by means of statistical method. *Three times a week; second semester.* Dr. Stevens

[15. The Family.—Evolution of the family and marriage; educational, moral, and political significance of the family at different stages of social development. *Twice a week; both semesters.* (Not given, 1917-18.) Mr. Dennis]

21. Socialism and Economic Reform.—The same as Economics 21. *Two times a week; second semester.* Mr. Douglas

SPANISH

(See Romance Languages)

TRANSPORTATION

Transportation may be taken as a major or minor for the master's degree and as a minor for the doctorate. No student will be admitted to the graduate courses in transportation unless he has a satisfactory acquaintance with the principles of economics and in addition such knowledge of the general problems of transportation as is represented by the content of the undergraduate course on the transportation system of the United States.

Courses for Graduates

101. Railway Rate Policy.—*Twice a week; first semester. One unit.* Professor Dewsnup

102. The Fiscal Administration of American Railways.—*Twice a week; second semester. One unit.* Professor Dewsnup

[103. Foreign Railway Administration.—*Twice a week; first semester. One unit.* (Not given, 1917–18.) Professor Dewsnup]

104b. Standards of Railway Operation.—The work of this course requires a cycle of three years for its completion, tho credit will be given for each semester's work. 104a deals with organization and maintenance standards, 104b with the freight service, 104c with the passenger service. *Once or twice a week, at the option of the instructor; second semester. One unit.* Professor Dewsnup

Courses for Graduates and Advanced Undergraduates

2. Transportation Policy in Europe and the United States.—*Three times a week; second semester.* Professor Dewsnup

7. Railway Organization.—*Twice a week; first semester.* Professor Dewsnup

12. Freight Shipment.—*Twice a week; second semester.*

13. Freight Rates.—(A continuation of Course 12.) *Three times a week. first semester.*

[17. Railway Terminal Management.—*Three times a week; first semester;* (Not given, 1917–18.) Professor Dewsnup]

22. Railway Train Service.—*Three times a week; second semester.* Professor Dewsnup

[26. The Economics of Railway Construction and Maintenance.—*Three times a week; second semester.* (Not given, 1917–18.) Professor Dewsnup]

ZOOLOGY

At least sixteen semester hours of college work in zoology are required for entering on major graduate study in this subject. Under special circumstances advanced work in closely allied subjects may be accepted in lieu of the fourth semester's work in zoology. When zoology is chosen for a minor the courses listed for graduates and undergraduates must be preceded by at least one full year's undergraduate work in zoology.

For the prosecution of graduate study in zoology a reading knowledge of German and French is indispensable and familiarity with Latin and Greek is of great advantage.

Every candidate for the doctor's degree is expected to spend at least one summer in study at the seashore. To facilitate this plan an investigator's room has been provided at the Woods Hole Marine Biological Laboratory, where members of the department are afforded research facilities without cost to themselves.

Application for the use of this room should be made to the head of the department early in the year. Similar facilities are afforded at the Harpswell Marine Laboratory.

Courses for Graduates

102. Selected Topics from Vertebrate Morphology.—Origin of vertebrates; segmentation of the head; morphology of special systems. *Twice a week; first semester. One-half unit.* Professor Kingsley

[107. Parasitology.—Structure and life history of animal parasites; their relations to disease; origin and biological significance of parasitism. *Twice a week; both semesters. One unit.* (Given in 1916–17 and in alternate years.) Professor Ward]

[109–109a. Physiological Ecology.—The regulatory mechanism of organisms; neutrality, osmotic pressure, immunity, and temperature in relation to natural environments. 109 *twice a week;* 109a assigned readings and reports. *One-half unit each.* (Given in 1916–17 and in alternate years.) Assistant Professor Shelford]

110–110a. Economic Ecology.—Application of principles of physiology and ecology to problems of fisheries and pollution; insect pests and weather; forestry and conservation; 110 *twice a week;* 110a assigned reading and reports. *Second semester. One-half unit each.* (Given in 1917–18 and in alternate years.) Assistant Professor Shelford

111. Experimental Ecology.—Repetition of published experiments in physiology and ecology. *Both semesters. One-half to two units.* Assistant Professor Shelford

115. Factors of Individual and Racial Development.—Experimental embryology; regeneration; heredity; variation; evolution. *Twice a week; both semesters. One unit.* Professor Zeleny

117. Faunistic Zoology.—Problems in taxonomy and distribution. Students have the advantage of the collections, library, apparatus, and operation of a natural history survey of the State now in progress at the University. *Twice a week; both semesters. One-half to two units.* Professor Smith

Individual Research Courses

121. Invertebrate Morphology and Parasitology.—*One to two units.* Professor Ward

122. Vertebrate Morphology.—*One to two units.* Professor Kingsley

123. Faunistic and Systematic Zoology.—*One to two units.* Professor Smith

124. Experimental Zoology.—*One to two units.* Professor Zeleny

125. Animal Ecology and Behavior.—*One to two units.* Assistant Professor Shelford

127. Theories of Animal Phylogeny.—Relations of various groups of animals; signification of so-called intermediate forms; invertebrate larval forms and theories of descent based on them. *Once or twice a week; both semesters. One unit.* (Given in 1917–18, and in alternate years.) Professor Ward

Courses for Graduates and Advanced Undergraduates

3. Microscopical Technique and General Vertebrate Embryology.—*Twice a week; first semester.* Professor Kingsley

6. Vertebrate Organogeny.—Development of the organs of the vertebrate body. (A continuation of course 3.) *Three times a week; second semester.* Professor Kingsley

8a–8b. Thesis Investigation.—Individual work on assigned topics. *Both semesters.* Various instructors

11. Experimental Ecology and Geography.—The physiology of environmental relations, facts, principles, and methods of analysis of behavior. World and regional aspects of behavior and ecology including animal distribution as related to climate and vegetation. *Two or four times a week; first semester.* Assistant Professor Shelford

17. Field Zoology.—Collection, preservation, and identification of common representatives of lower vertebrates and of various groups of land and fresh-water invertebrates; identification of living and preserved material; habits and life histories of selected forms. *Three times a week; first semester.* Professor Smith

18. Advanced Field Zoology.—Restricted problems in connection with the local fauna; taxonomic or distributional problems. (A continuation of course 17.) *Two to five times a week; second semester.* Professor Smith

20a–20b. Current Literature.—*Once a week; both semesters.* Professor Zeleny

21a–21b. Introduction to Zoological Research.—Structure, life-history, or relations of invertebrate animals, especially parasitic forms. *Two to five times a week; both semesters.* Professor Ward

22–23. Morphology of Vertebrates.—The skeleton and the brain, the cranial nerves, and the eye and ear. *Two to five times a week; both semesters.* Professor Kingsley

25–26. Experimental Zoology.—Experimental embryology; regeneration; heredity; variation; evolution. *Two to five times a week; both semesters.* Professor Zeleny

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UNIVERSITY OF ILLINOIS BULLETIN

ISSUED WEEKLY

Vol XV. AUGUST 26, 1918 No. 52

Entered as second-class matter December 11, 1912, at the post office at Urbana, Illinois, under the Act of August 24, 1912. Acceptance for mailing at the special rate of postage provided for in section 1103, Act of October 3, 1917, authorized July 31, 1918.]

THE GRADUATE SCHOOL

OF THE

UNIVERSITY OF ILLINOIS

1918-1919

NOTE

Since the circular describing the Graduate School courses for 1918-19 was prepared the new draft law has made it necessary to change the divisions of the University year. The year is now divided into quarters of three months each instead of into semesters. The courses offered to graduate students will therefore be modified in respect to time and, where necessary, in credit value also in accordance with the change from the semester to the quarter plan. Before filling out their study lists students should consult the heads of departments in which they wish to take work in order to ascertain just what changes have been made in the various departments.

PUBLISHED BY THE UNIVERSITY OF ILLINOIS
URBANA

THE UNIVERSITY OF ILLINOIS

THE STATE UNIVERSITY

THE UNIVERSITY INCLUDES

The Graduate School, which offers courses of graduate study in all departments of the University.

The College of Liberal Arts and Sciences.

The College of Commerce and Business Administration.

The College of Engineering and the Engineering Experiment Station.

The College of Agriculture and the Agricultural Experiment Station.

The College of Law.

The College of Medicine (Chicago.)

The College of Dentistry (Chicago.)

The Schools of Education, Music, Library Science, and Pharmacy (Chicago).

The Summer Session of eight weeks, held each summer.

The State Laboratory of Natural History, the State Geological Survey, the State Water Survey, located at the University, all offer unusual facilities for research.

The Libraries at Urbana contain 400,187 volumes and 100,847 pamphlets.

For catalogs and information address

The University Registrar,

Urbana, Illinois.

THE GRADUATE SCHOOL

OF THE

UNIVERSITY OF ILLINOIS

Announcement for
1918-1919

PUBLISHED BY THE UNIVERSITY OF ILLINOIS
URBANA

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THE UNIVERSITY CALENDAR
1918-1919

As Applicable to the Graduate School

FIRST SEMESTER 1918-1919

1918	
Sept. 16, 17, Monday, Tuesday	Registration days
Sept. 18, Wednesday, 8 a. m.	Instruction begun
Nov. 4, Monday, 5 p. m.	Latest day for announcement of subjects for graduate theses
Nov. 28, Thursday	Thanksgiving Day
Dec. 2, Monday	Illinois Day
Dec. 21, Saturday, 11 a. m.	Holiday recess begun
Dec. 31, Tuesday, 5 p. m.	Latest day for submission of outlines of theses by candidates for professional degrees in engineering
1919	
Jan. 3, Friday, 1 p. m.	Instruction resumed
Jan. 23, Thursday	Semester examinations begun
Jan. 30, Thursday	Semester examinations ended

SECOND SEMESTER, 1918-1919

Feb. 3, 4, Monday, Tuesday	Registration days
Feb. 5, Wednesday, 8 a. m.	Instruction begun
Feb. 12, Tuesday	Lincoln Day
April 1, Tuesday, 5 p. m.	Latest day for filing of completed theses by candidates for professional degrees in engineering
April 17, Thursday, 11 a. m.	Easter recess begun
April 22, Tuesday, 1 p. m.	Instruction resumed
May 17, Saturday, 12 m.	Latest day for receipt by the Dean of the Graduate School of certified copies of doctors' theses
May 29, Thursday, 8 a. m.	Final examinations begun
June 7, Saturday, 12 m.	Latest day for receipt by the Dean of the Graduate School of certified copies of masters' theses
June 5, Thursday	Final examinations ended
June 8, Sunday	Baccalaureate address
June 10, Tuesday	Alumni Day
June 11, Wednesday	Forty-eighth Annual Commencement

THE EXECUTIVE FACULTY

EDMUND JANES JAMES, PH.D., LL.D., PRESIDENT OF THE UNIVERSITY

DAVID KINLEY, PH.D., LL.D., *Professor of Economics and Dean*
ALBERT PRUDEN CARMAN, A.M., D.SC., *Professor of Physics*
WERRETT WALLACE CHARTERS, PH.D., *Professor of Education*
JULIUS GOEBEL, PH.D., *Professor of Germanic Languages*
GEORGE ALFRED GOODENOUGH, M.E., *Professor of Thermodynamics*
HARRY ALEXIS HARDING, PH.D., *Professor of Dairy Bacteriology*
LAURENCE MARCELLUS LARSON, PH.D., *Professor of History*
HERBERT WINDSOR MUMFORD, B.S., *Professor of Animal Husbandry*
WILLIAM ABBOTT OLDFATHER, PH.D., *Professor of Classics*
STUART PRATT SHERMAN, PH.D., *Professor of English*
ARTHUR NEWELL TALBOT, C.E., *Professor of Municipal and Sanitary Engineering*
EDGAR JEROME TOWNSEND, PH.D., LL.D., *Professor of Mathematics*
HENRY BALDWIN WARD, PH.D., *Professor of Zoology*
CHARLES MAXWELL MCCONN, A.M., *Registrar, Secretary of the Faculty*

HISTORY AND ORGANIZATION

The University of Illinois offered facilities for advanced study and research in various lines as early as 1872. Organized graduate instruction, however, under the name of the Graduate School, was first undertaken in 1892. In 1894 the administration of the school was vested in the Council of Administration, and the Vice-President of the University became Dean of the School. In 1906 the Graduate School was organized as a separate faculty, consisting of a dean and members of the University faculty assigned to this duty by the President.

By action of the Trustees the teaching faculty of the Graduate School includes all members of the University faculty who give instruction in approved graduate courses. The affairs of the School, however, are in charge of the Executive Faculty appointed each year by the President.

ADMISSION

Admission to the Graduate School may be granted to graduates of institutions whose requirements for the bachelor's degree are substantially equivalent to those of the University of Illinois, and to applicants from other institutions approved by the Executive Faculty, as hereinafter provided. *Admission to the Graduate School does not, however, imply admission to candidacy for an advanced degree, and gives no right or claim to be so admitted. Such candidacy is determined by the Faculty after the student has demonstrated by his work here, for from two to five months, that he has the ability to do major work of graduate character. A mere accumulation of "credits" or "grades" is not sufficient.*

A graduate of an institution meeting the requirements of a standard college, as described below, may be admitted to the Graduate School, provided he satisfies the Dean and the departments concerned that he will be able to proceed to the master's degree in a period not exceeding two years.

For purposes of admission to the Graduate School a *standard college* is one which meets the following requirements:

1. An enrollment of not fewer than one hundred students of college grade, with an average for a series of years of at least twenty-five per cent registered in the junior and senior classes.

2. A graduation requirement of four years (120 semester hours) of collegiate grade.

3. A minimum entrance requirement of 14 units. By the minimum requirement is meant the smallest number of units with which a student may be permitted to begin college work, i. e., the nominal requirement minus the number of units of conditions allowed.

4. A requirement that all entrance conditions must be removed before a student may be permitted to begin a second year of work in the same institution.

5. Not less than eight distinct departments in liberal arts and sciences, with at least one professor giving full time to college work in each department.

6. A minimum educational attainment of all college teachers of academic subjects equivalent to graduation from a college of high grade and graduate work equal to that required for the master's degree at the University of Illinois.

7. A maximum of 16 semester hours per week required of college teachers.

8. A maximum enrollment of 30 students in recitation or laboratory sections.

9. Buildings and equipment of the value of at least $100,000.

10. A productive endowment sufficient to yield a net annual income of at least $10,000 available for instructional purposes in the college department (liberal arts and sciences). If the institution offers courses in addition to the usual liberal arts course, it shall have a correspondingly larger income.

11. A library of not less than 10,000 bound volumes in addition to public documents.

12. Laboratory equipment of a value of not less than $3,000 in physics ($4,000 if work is offered in advance of one year-course), $2,500 in chemistry, and $2,500 in biology.

13. In addition to the foregoing specific requirements, the general standard of the administration and faculty shall be considered.

Admission to graduate courses may be granted only to those who have had the requisite undergraduate work in those courses or departments. But a student of mature age who satisfies the Dean and the department concerned of his ability to pursue graduate work in a given line may be enrolled in particular graduate courses, without reference to a degree, and permitted to carry on such study or investigation under the direction of a department of the University as the department shall recommend and the Dean approve.

Application blanks for admission may be secured from the Registrar of the University. Every applicant must submit with his application for admission an official transcript of his college record.

CHARACTER OF GRADUATE WORK

The principal aim of graduate study is the development of the power of independent work and the promotion of the spirit of research. Each candidate for a degree is expected to have a wide knowledge of his subject and of related fields of work; for the graduate student is not expected to get from lecture and laboratory courses all the knowledge and training necessary to meet the requirements for his degree.

Students, especially candidates for the doctor's degree, are warned against restricting themselves to the courses prescribed or suggested by the departments in which they are studying. Each student is expected to do a wide range of private reading and study, and in many cases will find it advisable to take one or more courses of lectures quite outside the field of his chosen subject.

REGISTRATION AND PROGRAM OF STUDY

The following regulations concerning registration and program of studies are laid out primarily for first-year students. Second-year and third-year graduate students fill out their programs irrespective of the unit value of courses, according to their needs, under the advice of their instructors.

Registration.—Each graduate student must register when he first connects himself with the University and afterwards at the beginning of each semester.

The registration of a new student may be accepted at any time provided the student is prepared to take up courses actually under way. Credit towards the fulfillment of the residence requirement dates, however, from the time of registration and not from the beginning of the semester or year in which the student enters. Registration will not be permitted later in the year than April 1, except in the case of students who expect to continue through the summer session, or are returning to complete a year's work which has been broken into by illness or other unavoidable interruption.

The first registration, or that upon entrance, is permitted only after the student's application for admission to the Graduate School, setting forth his educational attainments, has been duly approved.

A new student must fill out in duplicate an application for admission and submit it to the Registrar, from whom, after the approval of his application, he will receive a card of admission and a study-list which will give details of procedure in registering. He should fill out the study-list after consultation with his adviser, or the person in charge of his major work, and also with the instructors whose courses he wishes to elect. *In all cases, registration must be completed within two weeks.* Otherwise it is subject to a fee of one dollar.

Changes in Study-Lists.—A graduate student is expected to plan his work so carefully that changes in his study-list during the semester will not be necessary. When a change seems advisable, however, it may be permitted without fee if made within three weeks of the date of registration. After that date a fee of one dollar is charged for each change, except that the total charge for a rearrangement authorized on any one change slip shall not exceed two dollars.

Advisers.—The person in charge of the major work of the student becomes his adviser, and, together with those with whom the student is taking first and second minor courses, forms a committee with general supervision over the student's general course of study. This committee is expected to follow the student's work, to assist him in planning his course and to give him such advice as may be necessary concerning his scholastic career.

Undergraduate Courses Open to Graduate Students.—Courses to which sophomores are regularly admitted may not be taken for graduate credit, either major or minor.

Unless otherwise specified on the student's program by the department concerned, a course for graduates and advanced undergraduates, not open to students below senior grade and counting four or five hours of undergraduate credit, if taken by graduate students, will be treated as a unit course; when counting less than four hours of undergraduate credit, such a course, if taken by graduate students, will be treated as a half-unit course.

Unless otherwise specified on the student's program by the department concerned, a course the prerequisites of which are such as make it possible for juniors to be admitted, if taken by a graduate student, is counted as a half-unit course or a quarter-unit course, according to the number of hours of undergraduate credit for which the course is given.

Transfer of Undergraduate Credit.—No credit earned during the undergraduate course may be transferred for graduate credit, unless such credit was earned in time additional to the time normally required for the bachelor's degree,

in the second semester of senior year, and then only for minor subjects, and on petition.

If at the end of the first semester of his senior year a student has so far completed his work for the bachelor's degree that his program for the second semester is not full, he may elect one or more graduate courses. But such election must be in accordance with Graduate School rules and must be approved by the Dean.

Failures.—A graduate student who fails in any course in his major subject cannot secure his degree in the same year in which the failure occurred. No condition examinations are given graduate students.

Miscellaneous and Listeners' Courses.—Graduate students are permitted under proper circumstances to attend classes as listeners, and to elect miscellaneous subjects, that is, courses which do not count towards an advanced degree. Listeners' cards may be obtained at the Dean's office. Under the authority conferred by the faculty on the Dean no student with a full minimum program will be permitted by the Dean to visit more than one class or to take more than one miscellaneous subject, nor is any subject open as a listener's or miscellaneous course unless it has a specific educational bearing on the student's major or minor subjects of study.

A student who elects a miscellaneous course is required to register in it, do the work, and pass the semester examinations, unless he is permitted to withdraw under the rules. A student who has a listener's card is not permitted to participate in the classwork or the examination.

No student may register for a full minimum program of work for graduate credit if it is necessary for him to carry at the same time more than one miscellaneous subject and to visit one course.

Students on the Staff.—Assistants and others on the University staff who undertake to do graduate work are permitted to take an amount of work determined by the terms of their employment. Such a student, if required by his engagements to teach more than five classes a week or to have laboratory work or supervision exceeding ten hours a week, may not receive his master's degree at the end of one year, nor his doctor's degree at the end of three.

The enrollment of a member of the staff is subject to the approval of the officer to whom he is responsible as a member of the staff and of the Dean of the Graduate School with reference to the amount of work to be taken. Before credit may be recorded for such graduate student at the end of a semester, the head of the department in which he is employed, or some one authorized by the head, must certify that the time given to graduate work by the student has not impaired the work for which he is paid by the University.

Residence and Work Done Elsewhere.—Continuous residence and study are required of all members of the Graduate School, unless they are granted leave of absence by the Dean, upon recommendation of the professor in charge of their work, for the purpose of carrying on elsewhere studies or investigation in the line of work for their degrees.

Students should note that all the work for the master's degree must be done in residence at the University, excepting in the case of members of the staff who have spent half of their time in study through a year at some other institution,

and then do the rest of the work required during a year in residence here. This privilege is extended also to high school teachers residing and employed in Urbana or Champaign.

Credit for work done elsewhere is not transferred. The candidate is examined here on all the work required for the degree.

Withdrawal.—If after registration a graduate student wishes to withdraw from any course or to add other work, he must first secure the necessary papers from the Dean's office. See the regulations concerning changes in study lists, page 11. If he wishes to withdraw from the University he must get clearance papers at the Dean's office.

DEGREES

Masters' Degrees

Character of Masters' Degrees.—The master's degree conferred depends upon the character of the bachelor's degree. The usual practise is that A.M. shall follow A.B., that M.S. shall follow B.S. However, this practise may be departed from in cases where the undergraduate course of study of the candidate was of a kind for which some reputable institutions in this country give A.B., while others give B.S. Such departure from the regular practise is permitted, however, only on individual petition duly approved.

Amount of Work Required.—Candidates for the degree of Master of Arts or Master of Science are required to do at least one full year's work in residence, including a thesis. By this is meant from four to five unit courses each semester, or their equivalent. A unit course is one which requires ten hours of time a week through one semester, irrespective of the mode of distribution of that time in class work, laboratory work and private study. Four such courses or their equivalent constitute a full *minimum* program for one semester, and eight such courses, or their equivalent, constitute the *minimum formal* year's work accepted for a master's degree. Only first rate students are permitted to secure a degree with this minimum program.

Unless otherwise permitted, on individual petition duly approved, every student must take each semester at least one course open to graduate students only (courses numbered 100 and upwards).

In the first year of his graduate study each student is required to attend a minimum of four formal class, lecture, or laboratory exercises a week. In no case is he permitted during his course to attend more than twelve a week, without permission.

Grades.—Student's work is graded in five classes, A, B, C, D and E. The last indicates a failure. D indicates unsatisfactory, though passable, work. The degree will not be awarded to any student who does not secure a grade of B or higher in three-fourths of the courses which he takes, including his thesis.

A failure or absence from examination in any course may prevent the conferring of the degree; and, as already indicated, failure in any course in the major field precludes the conferring of the degree in the same year.

Majors and Minors.—A candidate for a master's degree may do all his work in one subject, or he may select a major and one minor, or a major and two

minors. A major or minor denotes the field of knowledge of a department, or such part thereof as constitutes a separate and independent division of that field. For a master's degree a major is at least half the work, or a minimum of four units, for one year. Less than one unit may not be counted as satisfying the requirements of a minor without the approval of the department concerned.

A program of studies for a first-year graduate student which is limited exclusively to the investigation of a single problem will not be approved.

Foreign Language.—The ability to use one or more of the modern languages ordinarily studied in the undergraduate curriculum is expected of all candidates for the master's degree, and in some lines of study is required. On this matter students should consult the heads of the departments in which their major subjects lie.

Master's Thesis.—Each candidate for a master's degree is required to present a thesis on some subject approved by the professor in charge of his major work and the Executive Faculty of the Graduate School. The requirement of a thesis may be waived, however, upon the recommendation of the head of the department in which the student is doing his major work and the approval of the Dean, provided application to waive the thesis is made at the beginning of the year. *In no case will permission to take the degree without the thesis be given by the Dean if applied for later than the latest date for the approval of thesis subjects, as shown by the calendar.* A student excused from writing a thesis must replace it with additional courses of instruction.

No one will be excused from writing a thesis unless one-half of his program of studies consists of courses numbered 100 and upwards.

The thesis required from a candidate for a master's degree ordinarily will demand one-fourth of the student's time and may not exceed one-third of it. The thesis must be typewritten, on "thesis paper,"* and the title page must be printed. The thesis in its final form, together with a certificate of approval by the proper officer, must be left by the professor in charge at the Dean's office at the time set in the calendar. No article prepared for another use, or previously published, will be accepted as a thesis.

Under proper conditions a student may be permitted to complete the last fourth of his work, if devoted to his thesis, under leave of absence. To get such permission the student must have secured proper credit for at least six units; must petition for the privilege; must submit to the Dean an outline of the proposed investigation, approved by the head of his major department; and must submit satisfactory evidence that adequate facilities are available to him at the place where he intends to do the proposed work. Approval on all these points must be obtained one collegiate year before the thesis is due.

Graduate Study in the Summer.—Graduate students in the summer session are subject to the same scholastic requirements as those in the regular University year. Their study lists must be approved by the Dean of the Graduate School, or his representative. Attendance on four summer sessions of nine weeks each, or one semester and two summer sessions of nine weeks each, is considered the

*No other will be accepted by the Dean. "Instructions for the preparation of theses" may be obtained at the Dean's office.

equivalent of one year in residence. If in these sessions the required amount of work is properly done a master's degree may be earned in this way. The faculty is unwilling to accept summer-session work beyond the master's degree towards the doctor's degree, except in the case of a student who works in a summer session preceding or following a regular year's attendance at the University. In no case may the last year's work for the doctorate be done in disconnected summer sessions.

No course offered in the summer session may be taken for credit towards a higher degree unless it is specially described in the summer-session circular as accepted for that purpose.

Graduate students in the regular summer-session period are credited with only 8 weeks towards the fulfillment of the time requirement for the master's degree. It is necessary, therefore, for those who take work through four summer sessions for this degree to complete the residence requirement of thirty-six weeks by taking four additional weeks. This may be done at any summer session by continuing work after the close of the regular session, under the direction of the instructors with whom the student is working. The student is examined on the work thus done as on all other work, and must report his additional work to the Dean.

Summer Work in Medical Sciences.—Graduate courses in medical sciences are offered in the summer quarter between June and September at the College of Medicine of the University of Illinois in Chicago. Circulars describing the courses offered and conditions of admission and work may be obtained from the Secretary of the College of Medicine, Congress and Honore Streets, Chicago.

Marine Biological Laboratories.—Students in zoology, candidates for the master's degree, part of whose necessary preparation is experience in a marine or fresh-water biological laboratory or station, are permitted to offer, in part fulfillment of the requirements for the master's degree, work done in such fresh-water or marine laboratory; provided that the student who wishes to have such work accepted make application before beginning work in such laboratory; that the selection of the laboratory at which he is to work has been approved by the faculty beforehand; that the time to be spent in such work be not less than six nor more than nine weeks in any one summer; that the instructors under whom the student is to work have been previously accepted by this faculty; that he submit to an examination here on the work done at such laboratory; and that a certificate of attendance from a proper officer of the laboratory or station be submitted and a full written report of the work done in the shape of notes, or otherwise, be required; and that the student shall be in residence here at the University for one full academic year during which he shall do the rest of the work necessary for his degree.

The marine biological laboratories which have thus far been approved as institutions at which students of this University may take work for record here are:

Marine Stations:

Marine Biological Laboratory, Woods Hole, Massachusetts
Harpswell Marine Laboratory, Casco Bay, Maine
Puget Sound Station, Friday Harbor, Washington

Hopkins Marine Laboratory of Stanford University, Pacific Grove, California
Scripps Institute for Biological Research, University of California. LaJolla, California
Carnegie Institution Laboratory, Dry Tortugas, Florida
Bermuda Biological Station, Bermuda

Fresh-Water Stations:

Douglas Lake Station, University of Michigan, Topinabee, Michigan
Ohio State University Laboratory, Cedar Point, Ohio
University of Wisconsin Lake Laboratory, Madison, Wisconsin

Similar arrangements are made, under similar conditions, for students of geology in connection with Geological Surveys.

Masters' Degrees in Engineering

Two classes of second degrees are open to graduates of the College of Engineering, namely, academic and professional.

The academic second degree in engineering is Master of Science, following Bachelor of Science, in architecture, architectural engineering, civil engineering, electrical engineering, etc. This degree is conferred in accordance with the regulations described above for *academic work in residence only*.

The *professional* second degrees in engineering are as follows:

Master of Architecture, after B. S. in architecture.

Architectural Engineer, after B. S. in architectural engineering.

Civil Engineer, after B. S. in civil engineering or B. S. in municipal and sanitary engineering.

Electrical Engineer, after B. S. in electrical engineering.

Mechanical Engineer, after B. S. in mechanical engineering.

Engineer of Mines, Civil Engineer, Electrical Engineer, or Mechanical Engineer, after B. S. in mining or railway engineering, according to the course.

Professional degrees are conferred on two classes of candidates: (1) graduates of the College of Engineering of the University of Illinois who have been engaged in acceptable professional work away from the University for a period of not less than three years after receiving the degree of Bachelor of Science; (2) graduates of the University of Illinois, or of institutions of equal standing, who have been engaged in acceptable professional work in residence at the University for a period of not less than three years after receiving the degree of Bachelor of Science.

In "acceptable professional work" may be included contributions to technical literature, activity in professional societies, investigation of engineering problems, and the teaching of engineering subjects.

A candidate must declare his candidacy and file with the Dean of the College of Engineering, as chairman of the committee in charge, a detailed statement covering his professional study and experience, not later than the first Monday in November preceding the commencement at which he proposes to qualify. Prior to December 31 next succeeding, he must submit for approval an outline of his proposed thesis and he must file his completed thesis not later than April 1. If the statement of professional experience and study and the thesis are accepted,

the candidate must present himself at commencement in order to receive the degree.

Candidates for professional engineering degrees who already hold the degree of Master of Science may qualify for the professional degree after two years of professional work.

A candidate for a professional engineering degree must pay the incidental fee of thirty dollars on being notified that his professional study and experience are accepted as qualifying him to enter as a candidate for the degree. No one will be enrolled as a candidate for the degree at the following commencement who does not pay his fee at this time. When a candidate for a professional engineering degree has once been accepted and paid his fee, he is eligible to receive the degree at any time within five years, without additional fee, on completion of the requirements; provided, however, that unless he completes the requirements within two years his name will be dropped from the list of candidates and in order to receive the degree within the five-year period he must register once more.

The Degree of Doctor of Philosophy

Majors and Minors.—The requirements for the degree of Doctor of Philosophy are a thoro mastery of a selected field of study, evidence of the power of independent investigation in this field, a broad knowledge of the wider field of study of which this major subject is a part, a general acquaintance with related fields of knowledge, and a mastery of all branches of study which are necessary to a full knowledge of the main subject. Each student who is seeking this degree is expected to choose for study and final examination a major subject, or field of study, and a first and second minor. The major subject is the field in which the student expects to become expert and an authority. The first minor must be a subject closely related to the major and may, under certain conditions and with proper approval, be a subdivision of the major field of study. The second minor should be chosen outside of the major field of study, and must be so chosen by a candidate who elects a division of his major field for his first minor.

For the doctor's degree no definite division of a student's time among major and minors can be made, to hold in all cases. In general the faculty approves an arrangement which, distributing the student's time through the required three years, divides it equally among his three subjects in his first year of graduate study; in the proportion of two to one, as between his major and first minor, in the second year of graduate study (his second minor being finished and dropped at the end of the first year); and gives all his time to his major during his third year.

To put the matter in another way, a course of graduate grade (from among the "hundred" courses) meeting twice or three times a week, corresponding roughly to what is sometimes called a full course, or in our terminology a unit course, running through the year, should ordinarily be sufficient for a second minor; a similar course running through two years should ordinarily be sufficient for a first minor.

While "full-time work" in the first year of graduate study, leading usually to a master's degree, is at least eight units for the two semesters, full-time work

after the first year is not reckoned in units. The student is simply required to devote all his time to his work. Nor is there any necessary correspondence between the number of courses taken and the number of units required in the first year, or full-time work in any year. A first-year student might possibly secure all the credit necessary in two or three courses; and a second-year or third-year student might conceivably be devoting all his time to one course and his research or to his research alone.

Period of Study.—The *minimum* period of study required for securing the degree of Doctor of Philosophy is three years, during which the student is required to devote all his working time to his studies. All three years must be spent in residence at some accredited educational institution and either the first two or the last one of the three must be spent at the University of Illinois. The degree is conferred, however, not for residence during a certain period, but for scholarly attainments and power of investigation, as proved by thesis and examinations.

Credit for work done in other universities is not "transferred." The candidate is examined here on the subjects offered by him for the advanced degree. However, his period of residence at another institution of proper grade may be accepted in fulfillment of the residence requirement of the University of Illinois, so far as it goes.

Preliminary Examination.—Towards the end of his second year of study, or, by special permission, at the beginning of his third year, the candidate for the degree must submit to a preliminary examination, in order to determine whether he will be accepted as a candidate for the degree in the following year. This examination is intended to test the student's knowledge of the fields of his major and minor subjects of study. It is partly oral, and may be wholly so.

Language Examination.—The candidate will be required to demonstrate his ability to read French and German and other languages needed in his work. This test of proficiency in the use of French and German takes place not later than the time of the preliminary examination for admission to candidacy.

Final Examination.—On or before the last Monday in May of the year in which the candidate expects to come up for his degree, he must submit to a final examination, given by a committee appointed by the Dean. This examination is primarily on the research work of the student, as embodied in his thesis, but it is not confined to that. It extends to the whole field of the study of the candidate. It will not be confined to the courses which the candidate has attended in the University of Illinois only, if he has done part of the work elsewhere; nor even to the field covered by the courses specifically taken in this or other universities; but will be so conducted as to determine whether the candidate has a satisfactory grasp of his major subject as a whole, and a general acquaintance with the fields of knowledge represented by his course of study.

The final examination may not be divided. The examination must be taken all at one time even tho it requires several sessions.

Other Examinations.—Before the candidate is admitted to the final examination and the defense of his thesis, he may be required to take any other examination, oral or written, that is thought proper by the various departments in which

he has studied. If, after having passed his preliminary examination, he fails in the third year of his study to meet the expectations of the professors in charge of his work, or in any way fails to maintain the standard of scholarship and power of research expected of him, he may be refused admission to the final examination.

The above examinations are in addition to those in the courses for which the student is registered. These must be taken at the times for which they are set in the examination schedule.

No candidate who does not secure a record of B or higher in at least three-fourths of his work will be recommended for the degree.

Thesis.—The power of independent research must be shown by the production of a thesis on some topic connected with the major subject of study. The candidate is expected to defend his thesis or dissertation before the members of the faculty, or as many of them as may wish to question him about it, in connection with his final examination.

The subject of the thesis should be chosen not later than the end of the second year of study and must be submitted for formal approval by the faculty not later than the first Monday of November of the year when the degree is expected. Unless previously printed with proper authority, a typewritten copy of the complete thesis, *on thesis paper**, must be in the hands of the Dean not later than noon of the Saturday nearest the middle of May, for submission to the examining committee.

The doctor's thesis must be printed and one hundred copies deposited in the Library of the University by the candidate, not later than the first of June preceding the conferring of the degree. In form, the printed thesis must follow the "instructions for the preparation of masters' and doctors' theses," copies of which may be obtained at the Dean's office on application. If it is not printed by the first of June, the student must, not later than that date, deposit seventy-five dollars ($75) or a bond for that amount satisfactory to the Comptroller of the University and the Dean of the Graduate School. A member of the faculty of the University of Illinois will not be accepted as a guarantor on such a bond. If a bond is accepted, it must be replaced at the end of one year with a cash deposit. At the end of two years, if the thesis has not then been printed by the student, the University will print it or such part of it as is deemed best.

The cash deposit made by the student who does not print his thesis by the end of the second year after his degree is conferred becomes the property of the University, to be used for the general purpose of printing theses.

The title-page of each thesis, whether typewritten or printed, must bear the words, "Submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in—[here put the major subject]—in the Graduate School of the University of Illinois." The title-page must also contain the full name of the author, his previous degrees, the full title of the thesis, the year of imprint and, if a reprint, the title and volume and a statement of the pagination of the volume from which it is reprinted. Each thesis must have an appendix giving a short biography of the candidate, including the institutions he has attended, his

*No other will be accepted by the Dean.

degrees and honors, the titles of his publications, and such other matters as are pertinent.

Doctor's Degree in Engineering.—The degree of Doctor of Philosophy in Engineering is offered in certain lines of academic work of a high scholastic type in engineering science for students who wish to prepare themselves as teachers, investigators, and experts.

The general requirements for this degree, as to preliminary education, linguistic attainments, etc., are the same as in other lines.

The following lines of engineering science are open as majors:

Engineering mechanics
Steam engineering
Hydraulic and sanitary engineering
Electrical engineering
Heating and ventilation engineering
Railway engineering
Masonry construction and structural engineering
Coal-mining engineering

The first minor may be any of the above or one of the following fundamental sciences or an authorized combination of two of them:

Theoretical mechanics
Mathematics
Thermodynamics
Chemistry
Geology
Physics (Experimental or mathematical)
Zoology
Botany

The second minor should be in other than engineering subjects.

SCHOLARSHIPS AND FELLOWSHIPS

A number of scholarships and fellowships have been established by the Trustees of the University. To first-year graduate students of ability and promise there are open a number of scholarships with a stipend of $250 each and freedom from tuition, incidental, and laboratory fees. To second-year and third-year graduate students, that is, those who have had one or two years of graduate study there are open fellowships with a stipend varying from $300 to $500, with freedom from the above-mentioned fees. The larger stipends are given only to students who are expected to take their degrees within the year. Each holder of a fellowship or scholarship must pay the matriculation fee of ten dollars, unless he holds a first degree from the University of Illinois, and also the diploma fee of five dollars on receiving his diploma.

Candidates for these scholarships and fellowships must be graduates of the University of Illinois, or of colleges or universities having equivalent requirements for bachelors' degrees.

Application must be made on blanks to be obtained from the Dean of the Graduate School. These application forms should be sent to the Dean of the Graduate School as early as possible in February of the academic year preceding

that for which the fellowship is desired. No application will be considered if received later than March first, until after April fifteenth, the date when appointees from the first list of applicants must accept or refuse their appointments.

Persons appointed are notified on April first and must send the Secretary of the Board of Trustees notice of their acceptance or refusal by April fifteenth; and must agree that, if accepted, the appointment will not be resigned to take a similar one in any other institution during the year for which it is awarded.

Nominations to fellowships are made on the grounds of worthiness of character, scholastic attainments, and promise of success in the principal line of study or research to which the candidate proposes to devote himself. Scholarships and fellowships are not given to candidates who are over thirty years of age at the time when the appointment is to be made.

For second-year fellowships, adequate preparation in French, and for third-year fellowships, adequate preparation in French and German is required.

An appointment as honorary fellow, without stipend, may be made as specified for paid fellowships in the case of any one who has shown distinguished merit in his work.

LIBRARIES

The general University library, the library of the State Laboratory of Natural History, that of the State Geological Survey, and that of the College of Law are all at the University in Urbana. The libraries of the School of Pharmacy and the College of Medicine are in Chicago.

These libraries contain 423,063 volumes, and 105,347 pamphlets. Of these, 400,187 books and 100,847 pamphlets are in the libraries at Urbana; the rest are in Chicago. The library at Urbana also contains 2,042 maps and 4,318 pieces of sheet music. The departments at Urbana currently receive 5,268 periodicals, while the College of Medicine and School of Pharmacy in Chicago receive 244.

The general library of the University is open daily, from 8 a. m. until 10 p. m. and on Sunday from 2 p. m. to 6 p. m.

The Mason Historical Library.—The library of western history collected by Edward G. Mason, Esq., long President of the Chicago Historical Society, is in the Public Library of the city of Champaign, and is accessible to University students.

The Dittenberger Classical Library.—The University possesses the library of Wilhelm Dittenberger, at one time Professor of Classical Philology in the University of Halle. This library contains 5,600 items. It includes the works of the poets and prose writers, numerous works on grammar and history of literature, and between four and five thousand dissertations and programs on special topics. There are also many works dealing with other departments of classical philology, as epigraphy, history of ancient peoples, archeology, philosophy, history of art, geography, chronology, metrics, etc.

The Heyne Library of Germanics.—The library of Professor Moritz Heyne of the University of Göttingen was bought by the University. It contains about 5,200 volumes. The collection is rich in the general field of German philology and in lexicography. It has many rare first editions of works of German liter-

ature from the sixteenth, seventeenth, and eighteenth centuries and has sets of a number of rare periodicals.

The Gröber Library in Romance Languages.—The University also possesses the library of Professor Gröber of the University of Strassburg. This library contains about 6,500 titles.

The Vahlen Library, of the late Johannes Vahlen, contains about 10,000 volumes and is in itself an excellent working library in classical philological literature. It is well supplied with texts of Greek and Latin authors.

The Aron Library, collected by the late teacher and student of pedagogy, R. Aron, contains about 20,000 volumes. It is a scholarly collection of educational documents, among them many original and early editions, and furnishes firsthand material for the study of educational movements in Europe, especially in Germany, from the time of Luther and Comenius to the present. The collection of German "Fibeln" or school readers is unique, and the material for the history of juvenile songs and literature, the set of 17th and 18th century atlases, and the collection of rare hymn books and juvenilia make the collection very useful to students of education.

FEES AND EXPENSES

Except as noted below, graduate students pay fees as follows:

Matriculation fee	$10.00
Incidental fee, each semester	15.00
Diploma fee	5.00
For late registration	1.00
For changes in study-lists	1.00

All graduate students who have not matriculated as undergraduates at the University of Illinois pay the matriculation fee on entrance.

All graduate students pay the diploma fee.

No tuition or incidental fee is charged for graduate courses to scholars, fellows, or members of the corps of instruction or the staffs of the scientific bureaus or experiment stations who are appointed by the Board of Trustees, nor for undergraduate courses on their study-lists if approved by the heads of the departments and by the Dean of the School as necessary or desirable for the proper completion of the work for the degree. Otherwise graduate students who take undergraduate courses must pay the proper undergraduate fee.

Each student working in the laboratories, or in the drafting or engineering classes, is required to make a deposit of from 50 cents to $10.00, to pay for chemicals and apparatus used, and for any breakage or damages. But no charges or deposits for laboratory materials are required from scholars, fellows, or members of the corps of instruction or scientific staffs mentioned above.

Table board may be obtained at prices ranging from $4.50 a week.

Room rent, with two in a room, ranges from $2.50 a week.

THE GRADUATE CLUB

The Graduate Club is an unofficial organization of the graduate students and faculty. Its purpose is to furnish an opportunity for those working in different departments to become acquainted with one another and thus counteract the tendency toward narrowness which intense specialization may sometimes induce.

DEPARTMENTS OF INSTRUCTION

Courses open to graduate students are of two classes. The first class is wholly of graduate grade, and the courses are numbered 100 upwards. The second class includes the courses classified as for graduates and advanced undergraduates. These carry numbers below 100. The courses numbered 100 and upwards are all accepted for major credit. Those of the other group are in many cases accepted only for minor credit. This is especially true of courses which are open to juniors.

All courses have certain prerequisites for admission. Inasmuch as the prerequisite preparation may be gained at other institutions from courses differing from those offering a similar preparation at the University of Illinois, so that a statement of prerequisites as given here would not be understood elsewhere, their description is omitted altogether. However, a student who wishes to enter a particular course must satisfy the department concerned that he has had in some form the prerequisites for admission to the course.

For the convenience of first-year students the credit value of graduate courses is given in units. These values have no significance for second-year and third-year students.

The credit received for "courses for graduates and advanced undergraduates" is in accordance with the regulations of the Graduate School circular, page 11.

Students are admitted to graduate standing in agriculture who have had a thoro training in the sciences underlying agriculture, and who are otherwise eligible to the Graduate School, even tho their undergraduate course of study lacked to some extent the amount and kind of technical work in agriculture included in the course of study for the bachelor's degree in agriculture at the University of Illinois.

ACCOUNTANCY

These courses may be taken for second minor credit only. They may be chosen only by students who have had at least two years' previous training in accountancy and whose major subject is economics (including commerce), business organization, railway administration, engineering, or agriculture.

Courses for Graduates and Advanced Undergraduates

3a–3b. Accounting Problems and Auditing.—Must be taken throughout the year in order to secure credit. *Three times a week; both semesters.*

Assistant Professor Scovill

4a–4b. Cost Accounting.—(a) Cost accounting applied to factory procedure, overhead expense, the installation and control of cost systems, presentation of cost data; (b) as a basis for manufacturing efficiency; (c) the construction of cost systems. *Twice a week; both semesters.*

Assistant Professor Scovill

13a–13b. Governmental Accounting.—*Twice a week; both semesters.*

Mr. Morey

AGRONOMY

Students taking their major work in agronomy must have had the major courses in agronomy offered to undergraduates in the College of Agriculture of the University of Illinois, or their equivalent. Graduate students may specialize either in soils or in crops. Courses 7, 11, and 12, or the equivalent, will be required of graduates who specialize in soils and courses 7, 12, and 22, or the equivalent will be required of those specializing in crops. While everyone seeking a doctor's degree with agronomy as a major will be required to have a general knowledge of the whole field of agronomy, each student is expected to prepare a thesis in some one of the divisions, soil fertility, soil physics, soil biology, plant breeding, or crop production.

Students who are taking their major work in other departments and choose agronomy as a minor, must have had previously the work in chemistry, botany, and other fundamental sciences prescribed for the undergraduate courses in agronomy in the College of Agriculture, or the equivalent.

Courses for Graduates

101. Soil Investigations.—System of soil investigations; sources of error and methods of control; interpretation of results. *Twice a week; both semesters. One unit.* Professor Stewart

104. Seminary in Agronomy.—*Once a week; both semesters. Half unit.* Associate Professor Whiting and others

112. Plant Breeding.—Experiments at this station; methods and results reported from other states and from foreign countries. *Twice a week; both semesters. One-half to two units.* Professor Smith

114. Crop Production.—Crop ecology; methods and results of crop production investigations. *Once a week; both semesters. One-half to two units.* Professor Burlison

118. Investigations.—A special problem is chosen by each student. *Consultation one to five times a week for different students; both semesters. One to four units.* Professors Hopkins, Smith, Mosier, Stewart, and Burlison, Associate Professors Whiting and White

Courses for Graduates and Advanced Undergraduates

7. Advanced Farm Crops.—Climatic and soil factors; rotation; distribution of labor; cost of production; pure seed production; supply and consumption of products and by-products; storage and marketing. *Three times a week; second semester.* Professor Burlison

11. Soil Biology.—Biochemical activities of soil microorganisms in relation to soil fertility. *Five times a week; second semester.* Associate Professor Whiting

12a. Soil Fertility, Fertilizers, Rotations.—The influence of fertility; effect of different crops on the soil and on succeeding crops. *Twice a week; second semester.* Professor Hopkins

22. Plant Breeding.—Improvement of field crops; selection. *Twice a week; second semester.* Professor Smith

23. Plant Food Supplies.—The world's supply of plant food materials; utilization and conservation. *Twice a week; second semester.*

Professor Stewart

ANIMAL HUSBANDRY

Students entering graduate work in animal husbandry must have a thoro training in the fundamental principles of the subject either in connection with or in addition to a course of study in agriculture substantially equivalent to that offered in this University.

Courses for Graduates

103. Live Stock Experimentation.—Objects, methods, and the sources of error in experimental work dealing with the feeding, breeding, and management of farm animals. *Once a week, first semester. One-half unit.*

Professor Davenport

110. Animal Nutrition.—Biochemistry, digestion, metabolism, and nutritive value of proteins. *Twice a week; both semesters. One unit.*

Professor Grindley, Assistant Professor Mitchell

111. Animal Nutrition.—Biochemistry, digestion, metabolism, and nutritive value of fats and lipoids, carbohydrates, and inorganic substances. *Twice a week both semesters. One unit.* (Not given, 1918-1919.)

Professor Grindley, Assistant Professor Mitchell

112. Research.—Investigations along the following lines:

(a) Economic factors involved in meat production.

Professor Mumford, Professor Coffey, Professor Rusk

(b) Systems of live stock farming. Professor Handschin

(c) The valuation of pedigrees. Professor Mumford

(d) Animal nutrition. The chemistry of feeding stuffs; metabolism experiments and biochemical studies connected with the nutrition of farm animals.

Professor Grindley, Assistant Professor Mitchell

(e) Genetics. Problems in heredity and variation.

Associate Professor Detlefsen

(f) Factors affecting the quality, quantity, strength, and condition of wool.

Professor Coffey

(a), (b), (c), and (f), one to three times, (d) and (e), five times a week; both semesters. One to two units. These courses may be taken during the summer by special permission.

117. Genetics.—Genetic experiments; biological and mathematical methods employed; the validity of the conclusions. *Two to five times a week; both semesters. One to two units.* Associate Professor Detlefsen

Courses for Graduates and Advanced Undergraduates

7. Principles of Animal Nutrition.—*Five times a week; first semester.*

Assistant Professor Mitchell

22. Advanced Stock Judging.—Animal conformation with reference to

market and show yard form; quality and condition. *Five times a week; first semester.* Various members of the department

24. MEAT.—Influence of type, condition, age, sex, and feeds on the yield and market grade of meat products. *Once a week; second semester.*
Professor COFFEY

26. SWINE.—The economical production of pork. Problems and methods. *Once a week; second semester.*

27. SHEEP HUSBANDRY.—The industry in leading sheep growing countries and particularly in different parts of the United States. *Once a week; second semester.* Professor COFFEY

28. ADVANCED HISTORY OF BREEDS OF LIVE STOCK.—Methods of prominent breeders, and performances of great individual animals: beef, horses, sheep, and swine. *Once a week; first semester.*
Professor MUMFORD and other members of the department

29. SYSTEMS OF LIVE STOCK FARMING.—Farm management applied to live stock farming. *Twice a week; second semester.*
Professor HANDSCHIN, Mr. WILCOX

30. GENETICS.—Heredity and variation. *Daily; second semester.*
Associate Professor DETLEFSEN

31. ADVANCED COURSE IN ANIMAL NUTRITION.—Digestion; histology and composition of body tissues; metabolism of food nutrients; effect of food nutrients on metabolism; the fasting catabolism; food requirements and feeding standards; growth; nutritive value of proteins and amino acids. *Five times a week; second semester.* Assistant Professor MITCHELL

32. MARKETING LIVE STOCK.—*Twice a week; second semester.*
Professor MUMFORD, Mr. WILCOX

ARCHITECTURE AND ARCHITECTURAL ENGINEERING

The prerequisite for graduate work in architecture and architectural engineering is the equivalent of the undergraduate courses required at the University of Illinois for the degree of Bachelor of Science in architecture and architectural engineering in the branches of the subjects in which registration is desired.

Courses for Graduates

101.—ARCHITECTURAL CONSTRUCTION.—Design of special structures. *Twice a week; both semesters. One-half to one unit.*
Professor RICKER and Professor PROVINE

102.—SANITATION OF BUILDINGS.—Planning, design, and installation. *Twice a week; first semester. One-quarter to one-half unit.* Professor RICKER

103. ADVANCED ARCHITECTURAL GRAPHICS.—*Twice a week; both semesters. One to two units.* Professor PROVINE

104. ARCHITECTURAL DESIGN.—Advanced course. *Twice a week; both semesters. One to four units.* Associate Professor CURTIS

105. ARCHITECTURAL PRACTISE.—Contracts, specifications, and office methods. *Twice a week; first semester. One-quarter to one-half unit.*
Professor PROVINE

106. Architectural History.—Special research. *Twice a week; both semesters. One-half to two units.* Professor Ricker

ASTRONOMY

The prerequisites for graduate study in astronomy are mathematics through the calculus, a year's course in observational astronomy, and a course in college physics.

Courses for Graduates

101. Seminar. *Three times a week; both semesters. One unit.* Professor Stebbins

102. Stellar Astronomy.—Orbits of binary stars; variable stars; theoretical photometry. *Three times a week; both semesters. One unit.* Professor Stebbins

Courses for Graduates and Advanced Undergraduates

7–8. Theoretical Astronomy.—Celestial mechanics; theory of orbits; *Three times a week; both semesters. One unit.* Professor Stebbins

14. Observational Astronomy.—The working methods of an astronomical observatory. *Three times a week; second semester. One unit.* Professor Stebbins

15. Geodetic Astronomy.—The sextant, transit, and zenith telescope; methods similar to those of the United States Coast Survey. *Three times a week; first semester. One unit.* Professor Stebbins

BACTERIOLOGY

Instruction in bacteriology is offered by the departments of agronomy, botany, chemistry, and dairy husbandry. The work is offered under the supervision of a committee representing these departments.

Students who take a major in bacteriology must have had 10 semester hours of bacteriology and 15 semester hours of chemistry. The thesis may be chosen in any one of the following fields: general bacteriology, bacteriology of the dairy, of soils, of water and sewage, of animal diseases, or of plant diseases.

Candidates for the doctor's degree, with a major in bacteriology, will be held responsible for a general knowledge of all of the above mentioned fields in bacteriology.

A candidate for the doctor's degree, with a major in some field other than bacteriology, who elects a first or second minor in bacteriology must offer a minimum of four units for the first minor and a minimum of three units for the second minor selected from the courses listed below.

Courses for Graduates

Bacteriology

103. Physiology of Bacteria.—Fermentation; growth and death of bacteria. *Once a week; first semester. One unit.* Dr. Tanner

105. Classification of Bacteria.—Variability of species; characters; muta-

tions; standard and biometrical classification. *Once a week; second semester. One unit.* Dr. Tanner

107. Research.—(For those students who are taking a major in bacteriology either for the doctor's degree or the master's degree. Thesis work may be taken in any of the fields indicated below.) *Once a week; both semesters. One-half unit to four units.*

General Bacteriology	Dr. Tanner
Dairy Bacteriology	Professor Harding
Pathogenic Bacteriology	Dr. Tanner
Plant Pathology	Professor Stevens
Water and Sewage Bacteriology	Professor Monfort

Agronomy

118. Investigations in Soil Biology.—Special problems. *Consultation one to five times a week for different students; both semesters. One to four units.* Assistant Professor Whiting

Chemistry

110. Water Supplies.—Sources of contamination of water supplies; purification of water for potable or technical use. *One to five times a week; both semesters. One-half to one and one-half units.* Professor Monfort

Dairy Husbandry

104. Scientific Readings.—French or German texts. (Recommended for first and second year students.) *Once a week; both semesters. One-half unit.* Professor Harding, Associate Professor Prucha

105. Bacteriological Literature.—Each student is required to prepare and deliver an acceptable course of lectures. (Recommended for second year and third year students.) *Once a week or once in two weeks; both semesters. One-half or one unit.* Professor Harding

106. Research on Assigned Problems.—Open to graduate students whose development permits their undertaking problems of dairy bacteriology with only general supervision. *Once a week; both semesters. One-half unit to two units.* Professor Harding, Associate Professor Prucha

Courses for Graduates and Advanced Undergraduates

Bacteriology

8. Applied Bacteriology.—Water, sewage, and food bacteria. *Five times a week; second semester.* Dr. Tanner

18a–18b. Journal Meeting.—Required of all students majoring in general and pathological bacteriology. *Once a week; both semesters.* Dr. Tanner

20. General Bacteriology.—For seniors and graduate students who do not take bacteriology as a major. Assigned readings in foreign literature. *Five times a week; first semester.* Dr. Tanner

26. Pathological Bacteriology.—Cultural and morphological character-

istics of disease-producing organisms; immunity and serum reactions; routine diagnostic procedure. *Three times a week; second semester.* Dr. TANNER

27. EPIDEMIOLOGY.—The ways in which contagious diseases are spread and their control. *Twice a week; first semester.* Dr. TANNER

AGRONOMY

11. SOIL BIOLOGY.—Biochemical activities of soil microorganisms in relation to soil fertility. *Five times a week; second semester.*
Associate Professor WHITING

BOTANY

22a. MORBID HISTOLOGY.—Histology of the plant tissues; parasites in condition of disease. *Once a week; first semester.* Professor STEVENS

22b. BACTERIAL PLANT DISEASES.—*Once a week; second semester.*
Professor STEVENS

CHEMISTRY

10a. STUDY OF WATER SUPPLIES.—History, sources, contamination, and standards of purity of potable waters and waters for industrial purposes; analytical methods. *Three times a week; second semester.* Professor MONFORT

DAIRY HUSBANDRY

11. DAIRY BACTERIOLOGY.—Bacteria in milk and its products; sources, effect on milk, and methods of control. *Twice a week; first semester.*
Professor HARDING

12a–12b. Laboratory work supplementing Dairy Husbandry 11. *Four times a week; both semesters.* Professor HARDING, Mr. BREW

BOTANY

Candidates for advanced degrees in botany must offer for admission at least 20 hours in university botany, or 15 hours in botany and 5 hours in zoology or in entomology.

Graduate students who desire to elect botany for minor credit must offer the equivalent of 10 hours in university botany as well as any other stated prerequisites to the courses selected.

Courses for Graduates

101. INDIVIDUAL PLANT DEVELOPMENT.—Origin of the individual; external and internal factors in its development and physiologic performance; response of the cell, somatic and generative, to external factors. *Once a week; both semesters. One-holf to two units.* Professor HOTTES

102. PHYSIOLOGY.—Effects of external stimuli on growth and movement. *Once a week; both semesters. One-half to two units.* Professor HOTTES

104. MYCOLOGY.—Field and laboratory investigations of selected groups of fungi. *Once a week; both semesters. One-half to two units.* Professor STEVENS

106. Plant Pathology.—Diseases of plants, and disease agents. *Once a week; both semesters. One-half to two units.* Professor Stevens

108. Taxonomy.—Monographic studies of critical groups. *Once a week; both semesters. One-half to two units.* Professor Trelease

109. Ecology.—The interrelation of plants and their environment. *Once a week; both semesters. One-half to two units.* Assistant Professor McDougall

Courses for Graduates and Advanced Undergraduates

7b. Methods in the Study of Fungi.—Isolation, cultivation, and inoculation of fungi and bacteria. *Once a week; second semester.* Professor Stevens

9a–9b. Plant Anatomy or Physiology.—Problems to meet the needs of individual students. *Once a week; both semesters.* Professor Hottes

10a–10b. Current Botanical Literature.—A weekly review covering the field of botany; supplementary to the various seminar conferences. *Once a week: both semesters.* Professor Trelease

14a–14b. Heredity, Variation, Evolution.—Cells and members of plants; adaptations and changes; mechanism of heredity; evolution. *Twice a week; both semesters.* Professor Hottes

16b. Taxonomy and Morphology of Algae and Bryophytes.—Advanced practise on selected groups. *Once a week; second semester.* Dr. Hague

17a–17b. Taxonomy of Cormophytes.—Advanced practise on selected taxonomic or economic groups. Specialized studies, as of genera or families of Illinois plants. *Once a week; both semesters.* Professor Trelease

22a. Morbid Histology.—Histology of plant tissues; parasites in condition of disease. *Once a week; first semester.* Professor Stevens

22b. Studies of Special Groups of Fungi or Diseases of Special Crops or Groups of Crops.—*Once a week; second semester.* Professor Stevens

25a–25b. Plant Ecology.—The ecology of plants or of plant communities. *Once a week; both semesters.* Assistant Professor McDougall

26. Taxonomy and Ecology of Higher Fungi.—Advanced practise on selected groups. *Once a week; first semester.* Assistant Professor McDougall

28a–28b. Taxonomy of Economic Fungi.—Advanced practise on selected groups of parasitic fungi. *Once a week; both semesters.* Professor Stevens

29a. Comparative Morphology of Pteridophytes, Bryophytes and Angiosperms.—Character and scope of work on problems of special interest, with repetition of some phases of this work. *Once a week; first semester.* Dr. Hague

BUSINESS ORGANIZATION AND OPERATION

Work may be done in the field of business organization and operation for a major or a minor for the M.S. degree, and for a minor for the doctorate. To do major work in this field, the student must have completed an undergraduate curriculum equivalent to that of the college of commerce and business administration. To do minor work, he must have had at least five semester hours' credit in the principles of economics and at least six semester hours in accounting and business law, respectively.

Courses for Graduates

101. Regulation and Control of Mercantile Distribution.—Federal, state, and local regulation of mercantile business; unfair competition; trade agreements; trade marks; inspection of mercantile establishments; pure food acts; control over weights and measures, packing, storage, and shipment. *Twice a week; both semesters. One unit.* (Not given, 1918-1919.)

102. Scientific Management.—The history of the scientific management movement; critical study of the proposed systems. *Twice a week; both semesters. One unit.*

Courses for Graduates and Advanced Undergraduates

4. Industrial Organization and Management.—Problems of organization and of administrative policy; supervision and management of industries and industrial units, etc. *Twice a week; second semester.*

CERAMIC ENGINEERING

Graduate work leading to degrees in either ceramic chemistry or ceramic engineering is offered by the department. Graduate students who wish to elect ceramic chemistry as their major field of study must have had the equivalent of twenty-five semester hours in chemistry and this must include satisfactory courses in general chemistry, qualitative and quantitative analysis, and either physical or organic chemistry. Such students must also have had at least one year of college physics and a training in mathematics which includes the calculus.

Candidates for the degree of Doctor of Philosophy in ceramic chemistry must fulfill the same general requirements in chemistry as candidates in other branches of chemistry. They must also offer physical chemistry as one of their minor subjects.

Courses for Graduates

101. The Chemistry of the Compounds of Silicon.—*Twice a week; both semesters. Three-fourths unit.* Professor Washburn

103. Silicon Chemistry.—Laboratory to supplement course 101, which must precede or accompany it. *One to two units. Second semester.* Professor Washburn

102. General Technology of the Clay Industries.—Physical properties of ceramic materials and products; dependence on chemical composition, mineralogical constitution, and physical condition. *One to two units. Both semesters.* Professor Parmelee

Courses for Graduates and Advanced Undergraduates

4. Drying and Burning.—Chemical and physical processes; types of equipment. *Four times a week. First semester.* Assistant Professor Hursh

5. Ceramic Bodies.—Composition and properties of ceramic body mixtures; effects of various ingredients; development of special bodies. *Second semester; daily.* Professor Parmelee

6. Glazes.—Classes of glazes and enamels; composition, limits, properties and defects. *First semester; daily.* Professor Parmelee

8. Glass.—Raw materials, preparation, compounding, melting, and shaping; chemical principles in the manufacture and decoration of vitreous silicates. *Second semester; twice a week.* Professor Parmelee

9. Ceramic Construction.—Plans, specifications, and estimates for ceramic equipments and industrial plants. *Second semester; four times a week.* Assistant Professor Hursh

10. Cements.—Cements, limes, plasters; composition; reactions; manufacture and testing. *First semester; three times a week.* Assistant Professor Hursh

13. Cement Laboratory.—Silicate cements. *Second semester; three times a week.* Assistant Professor Hursh

14. Cement Laboratory.—Lime and gypsum products; magnesia and other special cementing materials. *Second semester; three times a week.* Assistant Professor Hursh

15. Glass Laboratory.—Soda-lime, potash-lime, lead, barium, and zinc silicates; boro-silicates; fused and solidified glasses; problems. *Second semester; three times a week.*

16. Glasses and Enamels.—(Continuation of Ceramic Engineering 15.) Opaque, colored, and optical glasses; the enameling of metals. *Second semester; three times a week.*

17. The Principles of Physical Chemistry with Special Reference to their Applications to Ceramic Materials and Process.—*First semester; three times a week.* Professor Washburn

18. Ceramic Microscopy.—The use of the microscope in the examination of ceramic materials and products. *First semester; three times a week.*

20. Refractory Materials.—Properties and uses of refractory materials employed in the industries; relation between refractory power, chemical composition and physical condition; changes undergone by refractory materials at high temperatures. The subject will be presented as far as possible from the standpoint of the Phase Rule. Lectures and discussions. Assigned reading. *Second semester; twice a week. One-half unit.*

CHEMISTRY

Graduate students who elect chemistry as their major subject of study must have had the equivalent of 25 semester hours in chemistry, including satisfactory courses in general chemistry, qualitative and quantitative analysis, and either physical chemistry or organic chemistry. They must also have had one year of college physics, mathematics through analytical geometry and, if they do not present an acceptable course in physical chemistry, the calculus. The ability to use the calculus is a prerequisite to all courses in physical chemistry.

Before receiving a degree in chemistry the student must have completed work equivalent to courses 31, 33 (or 102 and 102a), 14a, 14b, 9a, 9b. He is advised to take at least brief courses in the history of chemistry, gas analysis, iron and steel analysis, water analysis, assaying, and chemical technology.

For students taking chemistry as a major, courses 14a, b, c, and d, 31, and 33 will be accepted only if on entering the Graduate School they have had the equivalent of 25 semester hours in chemistry.

Graduate students whose major subject is in some other department than chemistry, must have had the equivalent of 15 semester hours in chemistry. The ground covered must include satisfactory work in general chemistry and in qualitative and quantitative analysis. Such students are advised to make selections from the following courses: Chemistry 31, 33, (or 102, 102a,), 14a, 14b, 9a, 9b, 15, and 25. Students will not be admitted to courses of a special nature, for graduate credit, unless they have previously taken the appropriate prerequisite courses from the above list.

Courses for Graduates

CHEMISTRY 101. THEORIES OF CHEMISTRY.—Seminar. *Once a week; second semester. One-fourth unit.* Professor NOYES

102. ADVANCED PHYSICAL CHEMISTRY.—(This course with 102a covers a period of two years.) Thermodynamic methods. The first and second laws; the classical analytical method; Nernst heat theorem; energy, entropy, free energy, thermodynamic potential and fugacity; behavior of pure substances, solutions, heterogeneous systems, and chemical equilibria. *Twice a week; both semesters. Three-fourths unit.* Professor TOLMAN

102a. ADVANCED PHYSICAL CHEMISTRY.—(A continuation of 102.) Kinetic-molecular methods; kinetic theory of gases; entropy and probability; the quantum theory; molecular structure of liquids and solids; electron theory of matter; structure of the atom. *Twice a week; both semesters. Three-fourths unit.* (Not given in 1918-19.) Professor TOLMAN

102b. ADVANCED ELECTROCHEMISTRY.—Modern theories of solution; thermodynamics; transformation of chemical and electrical energy. *Three times a week; first semester. One unit.* (Not given, 1918-19.)

102c. ADVANCED PROBLEMS IN PHYSICAL AND ELECTROCHEMISTRY.—*First semester. One-half to one unit.* Professor TOLMAN

102e. SPECIAL TOPICS IN PHYSICAL CHEMISTRY.—Subject for 1918-1919. Statistical Mechanics. *Once a week; first semester. One-half unit.* Professor TOLMAN

102f. THE CHEMISTRY AND PHYSICS OF COLLOIDS.—Classification of disperse systems; adsorption; ultramicroscopy. Electrical, chemical, optical, and catalytic properties of colloids. *Twice a week; first semester. Three-fourths unit.* (Not given, 1918-1919, alternates with 102b.)

103. ADVANCED INORGANIC CHEMISTRY.—Descriptive inorganic chemistry; the rarer elements; periodic system. *Two to five times a week; both semesters. One-half to one and one-fourth units.* Assistant Professor HOPKINS

103a. ADVANCED ANALYTICAL CHEMISTRY.—*One to five times a week; second semester. One-half to one and one-fourth units.* Assistant Professor SMITH

103b. SPECIAL TOPICS IN INORGANIC CHEMISTRY.—Subject for 1918-1919: The chemistry of the higher order compounds, including the geometric and optical isomerism of inorganic compounds. *Twice a week; first semester. Three-fourths unit.* Assistant Professor SMITH

103c. Special Topics in Inorganic Chemistry.—Seminar. Rare earths. *Once a week; both semesters. One-fourth unit.* Assistant Professor Hopkins

103d. Special Topics in Inorganic Chemistry.—Subject for 1918-1919: Nitrogen and its compounds. The valence and fixation of nitrogen from theoretical and technical standpoints; assigned reading. Lectures; seminar. *Once a week; both semesters. One-half unit.* Dr. Anderegg

104. Advanced Organic Chemistry.—Geometric isomerism; optical isomerism; tautomerism; mechanisms of important reactions. *Twice a week; first semester. Three-fourths unit.* Assistant Professor Adams

104a. Advanced Organic Chemistry.—Special topics. Carbohydrates; proteins; ureides; alkaloids; terpenes; relationships between chemical constitution and physiological properties; color and constitution; trivalent carbon; bivalent carbon. *Twice a week; second semester. Three-fourths unit.* Assistant Professor Kamm

104b. Advanced Quantitative Organic Analysis.—The proteins, alkaloids, glucosides, volatile oils, and other constituents of animal and vegetable tissues. *Twice a week; both semesters. Three-fourths unit.* Assistant Professor Beal

104c. Organic Chemistry.—Current literature. *Once every two weeks; both semesters. One-fourth unit.* Assistant Professor Adams, Assistant Professor Kamm

104d. Advanced Organic Chemistry.—The benzene, naphthalene, and anthracene compounds; pyridines; pyriles. *Twice a week; first semester. Three-fourths unit.* Assistant Professor Adams

105. Advanced Physiological Chemistry.—Structure and distribution of proteins; intermediary metabolism and the glands of internal secretion. *Twice a week; second semester. Three-fourths unit.* Assistant Professor Lewis

105a. Advanced Physiological Chemistry.—Difficult biochemical preparations; the use of the newer analytical methods. *One to five times a week; first or second semester. One-half to one unit.* Assistant Professor Lewis

105b–105c. Advanced Physiological Chemistry.—Recent development. *Twice a week; both semesters. One-half unit.* Assistant Professor Lewis

105d. Chemistry of Plant Nutrition.—Organic compounds in plants. *Two to four times a week; both semesters. Three-quarters to one and one-fourth units.* Assistant Professor Beal

106. Animal Chemistry (Animal Nutrition).—*Five times a week; both semesters. One to one and one-half units.* Professor Grindley

107. Special Coal Problems.—Oxygen absorption; storage factors; deterioration and spontaneous combustion; unit coal values; contracts; specifications; inspection. *One to two times a week; first semester. One-fourth to one-half unit.* (Given first semester, 1917, and alternately with 107a.) Professor Parr

107a. Fuel Technology.—Fuel types: solid, liquid, and gaseous; sources, output, prospective supply, and industrial interrelations; conservation and combustion problems. *One to two times a week; first semester. One-fourth to one-half unit.* (Given first semester, 1918, and alternately with 107.) Professor Parr

107b. Special Topics in Gas Engineering.—Carbonization processes; by-product constituents and recovery. *One to two times a week; second semester. One-fourth to one-half unit.* Professor Parr

108. Advanced Metallography.—Selected alloy systems; correlation of constitution and properties. *Twice a week; first semester. Three-fourths unit.* Associate Professor McFarland

109. Advanced Industrial Chemistry.—Chemical industries; development and chemical control of processes. *Twice a week; both semesters. Three-fourths unit.* Associate Professor McFarland

110. Water Supplies.—Sources of contamination of water supplies; purification for potable or technical use. *One to five times a week; both semesters. One-half to one unit.* Professor Bartow, Acting Professor Monfort

111. Research.—*Both semesters.*

Physical and Electrochemistry. Professor Tolman
Inorganic Chemistry.
Assistant Professor Smith, Assistant Professor Hopkins, Dr. Anderegg
Analytical Chemistry. Assistant Professor Smith
Food Chemistry. Assistant Professor Beal
Organic Chemistry. Professor Noyes, Assistant Professors Adams and Kamm
Water Chemistry. Professor Bartow, Acting Professor Monfort
Physiological Chemistry. Assistant Professor Lewis
Animal Chemistry (Nutrition). Professor Grindley
Industrial Chemistry. Professor Parr, Associate Professor McFarland
Ceramic Chemistry. Professor Washburn

Courses for Graduates and Advanced Undergraduates

*6. Chemical Technology.—Technological chemistry as illustrated in those industries having a chemical basis for their principal operation and processes. *Three times a week; second semester.* Associate Professor McFarland

*7. Metallurgy.—General metallurgy; metallurgy of iron and steel. Fulton's *Principles of Metallurgy;* Stoughton's *Iron and Steel. Three times a week; first semester.* Associate Professor McFarland

7a. Metallurgy of the Non-Ferrous Metals.—Copper, lead, zinc, gold, and silver. *Three times a week; second semester.* Associate Professor McFarland

10a. Study of Water Supplies.—History, sources, contamination, and standards of purity of potable waters and waters for industrial purposes; analytical methods. *Three times a week; second semester.* Professor Bartow, Acting Professor Monfort

14a–14b. Organic Chemistry.—Noyes' *Organic Chemistry.* (This course should be accompanied by Chemistry 14c and 14d.) *Four times a week, first semester; twice a week, second semester.* Professor Noyes

14c. Organic Chemistry Laboratory.—Organic synthesis. *Twice a week; first or second semester.* Assistant Professor Adams, Assistant Professor Kamm

*Certain required inspection trips will be arranged in connection with courses 6 and 7. Students registering in these courses should take into consideration the expense involved, which will approximate $15.00 for each course.

14d. Organic Chemistry Laboratory.—Organic synthesis; quantitative and qualitative analysis. (Continuation of 14c, to accompany 14b.) *Twice a week; first or second semester.*

Assistant Professor Adams, Assistant Professor Kamm

15. Physiological Chemistry.—*Five times a week; first semester.*

Assistant Professor Lewis

15a. Problems of Metabolism.—Intended especially for Medical Students. *Twice a week; second semester.* Assistant Professor Lewis

21. Qualitative Organic Analysis.—Identification of pure organic compounds and mixtures. *Twice a week; first semester.* Assistant Professor Kamm

25. Food Analysis.—Quantitative organic analysis, with special reference to the examination of food products: alcohols, carbohydrates, fats and oils, cereals, nitrogenous bodies, preservatives, and colors. *Five times a week; first semester.* Assistant Professor Beal

27. Qualitative Analysis of the Rare Elements.—*Three times a week; second semester.*

28. Advanced Qualitative Analysis.—Designed especially for those intending to teach qualitative chemistry. *One to three times a week; first semester.*

31. Elementary Physical Chemistry.—Physical chemistry and electrochemistry. *Four times a week; second semester.* Professor Tolman

33. Elementary Physical Chemistry.—Molecular weights in gases and in solutions; chemical equilibrium; electrical conductivity of solutions and the phenomena within the solution; thermochemistry. (Laboratory to accompany course 31.) *Twice a week; second semester.* Dr. Dietrichson

35. Electrochemistry.—Electrochemical reactions. Technical applications, including electric furnace processes. *Three times a week; first semester.*

36. The Phase Rule and its Applications.—A study of equilibria in heterogeneous systems. Lectures and Seminar. *Twice a week; second semester.*

Dr. Dietrichson

38. The Chemistry and Physics of Colloids.—The classification of disperse system; adsorption; ultramicroscopy. Electrical, chemical, optical, and catalytic properties of colloids. Seminar. *Twice a week; second semester.*

Dr. Eastlack

45. Advanced Chemical Arithmetic.—Calculations of analytical and industrial chemistry reviewed and classified; use of tables, slide-rules, charts and calculating machines; graphical interpretation of chemical data; lecture, recitation, problems. *Twice a week; first semester.*

61. Industrial Chemistry Laboratory.—The preparation and purification of chemical products from raw materials on a scale sufficient to afford data for determining the economy of the processes employed. (This course should be accompanied by either 6 or 109.) *Three times a week; second semester.*

Associate Professor McFarland, Mr. Rowland

65. Fuels and Flue Gases.—Fuel inspection; gas analysis; determination of calorific values; calculation of efficiencies. *Three times a week; first semester.*

Professor Parr

66. Gas Engineering.—Gas machinery; ovens and appliances for carbonization; recovery of by-products. *Once a week; second semester.*
Professor Parr

66a. Control Processes in Gas Manufacture.—Standardization methods; gas yield; inspection of by-product. *Once a week; second semester.*
Professor Parr

69. Metallurgical Laboratory and Assaying.—The fire assay of gold, silver, lead, and copper ores, mattes, and bullion. *Twice a week; first semester.*
Associate Professor McFarland

72. Paints, Oils, Turpentines, Varnishes, and Protective Coverings for Wood and Metals.—*Twice a week; first semester.* Professor Parr

76. Chemistry of Oils.—Fractionation; analysis; evaluation for fuel; gas manufacture; lubrication. *Twice a week; second semester.* Given in 1918 and in alternate years.
Professor Parr

77. Composition and Classification of Coal.—Classification; changes in composition; formation of mine gases. *Once a week; second semester.*
Professor Parr

78. Metallography.—Constitution and microstructure of metals and alloys; properties, chemical and mechanical treatment, and structure. *Twice a week; second semester.* Associate Professor McFarland

95. History of Chemistry.—*Twice a week; first semester.*
Assistant Professor Smith

Besides the formal courses outlined above, regular scientific meetings are held by the colloquiums of industrial, physical, inorganic, physiological, and organic chemistry; by the Chemical Club; by Phi Lambda Upsilon, and by the University of Illinois Section of the American Chemical Society.

CIVIL ENGINEERING

The prerequisite for graduate work in civil engineering is the equivalent of the undergraduate course required for the degree of Bachelor of Science in civil engineering in the branches of the subject in which registration is desired.

*Courses for Graduates**

101. Irrigation and Drainage.—Survey, examination, construction, maintenance, and operation of works for irrigation and drainage of agricultural lands: the rights to the use of water. *Twice a week; both semesters. Half unit.*
Professor Newell

C. E. 103. Highway Construction.—Machinery and Methods of Handling Materials. Contractor's organization and official control. *Twice a week; both semester. One unit.* Professor Baker

106. Reinforced Concrete Design.—Elastic theory; specifications; concrete forms; typical structures; methods and costs. *Twice a week; both semesters. One and one-half units.* (Not given, 1918-19.)

107. Bridge Engineering.—Deflections; the statically indeterminate frame;

*Courses offered to Junior and Senior students are open for minor credit to students majoring in other fields.

swing bridges and arches; special graphical methods; suspension bridges; secondary stresses; impact. *Twice a week; both semesters. One unit or more.*

Professor Ellis

124. Steel Building Construction.—Steel framing of fireproof office, industrial, and hotel buildings; wind bracing; long columns; eccentrically loaded columns; eccentric connection; analysis of special details; erection methods and cost. *Twice a week; both semesters. One unit or more.*

Professor Ellis

THE CLASSICS

The Degree of Masters of Arts in the Classics.—The major may be either Latin or Greek.

Before the period of the regular course examinations of the second semester, each candidate must also pass two examinations which are to be regarded as tests of attainment rather than as a requirement of special or additional preparation. The first examination consists of written translation at sight, from the candidate's major language, or passages equivalent in difficulty to the work of first-year graduate courses. The second examination is oral and designed to determine the candidate's general ability and his advancement in the various fields of classical philology, especially those treated in course 110, Bibliography and Criticism.

The Degree of Doctor of Philosophy in the Classics.—The degree is given in classical philology. Major work may be taken in either Latin or Greek, but whichever language is taken as a major, the other must be taken as the first minor.

Greek

Preparation for first-year graduate work in Greek must include at least two years of preparatory Greek, two years of college Greek, and two years of college Latin. A reading knowledge of French or German, preferably the latter, is highly desirable for candidates in this subject. The study of history and philosophy is especially recommended.

Courses for Graduates

104. Homer and the Homeric Question.—*Twice a week; both semesters. One unit.* Professor Oldfather

105. Plato and Aristotle.—*Twice a week; both semesters. One unit.* (Not given, 1918-19.) Professor Oldfather

106. Greek Drama.—*Twice a week; both semesters. One unit.*

Professor Moss

107. Greek Oratory.—Speeches of several orators are read rapidly, and a detailed study made of one or two authors. *Twice a week; both semesters. One unit.* (Not given, 1918-19.) Professor Moss

Courses for Graduates and Advanced Undergraduates

(For minor credit only)

5. Herodotus: The Lyric Poets.—Selections. *Three times a week; first semester.* Professor Moss

6. THUCYDIDES.—Books VI-VII. *Three times a week; first semester.* (Not given, 1918-19.) Professor MOSS

7. THE DRAMA.—*Three times a week; second semester.* Professor PEASE

8. PLATO.—Selected Dialogues, including Phaedo; the Apology. *Three times a week; second semester.* (Not given, 1918-19.) Professor PEASE

14. GREEK PROSE COMPOSITION.—*Once a week; second semester.* Professor MOSS

21. See Latin 21.

LATIN

Preparation for first-year graduate work in Latin must include at least two years of preparatory Latin, and four years of college Latin, or three years of preparatory Latin and three years of college Latin. A reading knowledge of French or German, preferably the latter, is highly desirable. Some acquaintance with Greek is indispensable, and the study of history and philosophy is especially recommended.

Courses for Graduates

102. ROMAN ORATORY.—*Twice a week; second semester. One unit.* (Not given, 1918-19.) Associate Professor CANTER

103. CICERO.—The De Natura Deorum and the De Divinatione. The Epicurean, Stoic, and Academic theories of religion and their relation to the popular worship. *Twice a week; first semester. One unit.* Professor PEASE

104. LATIN PALAEOGRAPHY.—Material and form of ancient books; methods of copying; common errors in manuscripts; facsimiles of codices; text criticism. *Twice a week; first semester. One unit.* Professor PEASE

106. TERENCE.—*Twice a week; first semester. One unit.* Professor OLDFATHER

107. LATIN EPIGRAPHY.—Forms and language of inscriptions; selections from the Corpus Inscriptionum Latinarum. *Twice a week; second semester. One-half to one unit.* (Not given, 1918-19.) Professor PEASE

108. TACITUS.—The Histories. *Twice a week; first semester. One unit.* Professor BARTON

109. VIRGIL.—*Twice a week; second semester. One unit.* Professor PEASE

110. THESIS COURSE: BIBLIOGRAPHY AND CRITICISM.—All graduate students who are taking Latin or Greek as a major for the master's degree must take this course. *Once a week; both semesters. One unit.* Professors OLDFATHER, PEASE, and others

Attention is also called to Comparative Philology 2,—Comparative Philology of the Indo-European Languages.

112. ROMAN HISTORIOGRAPHY.—*Twice a week; first semester. One unit.* (Not given, 1918-19.) Associate Professor CANTER

113. PLAUTUS.—*Twice a week; first semester. One unit.* (Not given, 1918-19.) Professor OLDFATHER

114. CAESAR.—Historical works, especially the Bellum Gallicum. *Twice a week; second semester. One unit.* Professor OLDFATHER

115. Roman Elegy.—Relation to other lyric forms; translations from Catullus, Tibullus, and Propertius. *Twice a week; second semester. One unit.* (Not given, 1918-19.) Associate Professor Canter

Courses for Graduates and Advanced Undergraduates

7. Satire.—Selected Satires and Epistles of Horace and selected Satires of Juvenal. *Three times a week; first semester.*
Professor Pease

8. Tacitus.—The Annals, books I-VI. *Three times a week; first semester.* (Not given, 1918-19.) Professor Pease

14. Seneca.—Letters and tragedies. *Three times a week; second semester.*
Professor Barton

16. Martial and Suetonius.—*Three times a week; second semester.* (Not given, 1918-19.) Professor Oldfather

21. Special Topics in the History of Greece and Rome.—*Twice a week; second semester.* (Not given, 1918-19.) Professor Oldfather

22. Late Latin.—Rapid reading of selections from Latin Christian writers from Minicius Felix to Cassiodorus. *Twice a week; second semester.*
Professor Pease

COMPARATIVE PHILOLOGY

Courses for Graduates

2. Comparative Philology of the Indo-European Languages.—Greek, Latin, and the Germanic languages, including English. *Second semester; twice a week.* Assistant Professor Bloomfield

For Graduates and Advanced Undergraduates

1. Introduction to the Study of Language.—Phonetics; the development of forms of speech; dialects and the spread of languages; the study and teaching of languages. *First semester; three times a week.*
Associate Professor Bloomfield

3. Elementary Sanskrit.—*First semester; three times a week.*
Associate Professor Bloomfield

4. Elementary Sanskrit.—(Continuation of 3.) *Second semester; three times a week.* Assistant Professor Bloomfield

DAIRY HUSBANDRY

Candidates for the master's degree may take their major work in dairy husbandry, preparing a thesis in the field of dairy bacteriology, dairy chemistry, or milk production. Such students must have had at least 10 semester hours of previous work in dairy husbandry, including adequate preparation for the desired graduate courses.

Candidates for the master's degree desiring a minor in dairy husbandry must have had the introductory work regularly required to enter the desired course or courses.

Candidates who desire to register for a doctorate with their major interest in

dairy bacteriology as well as those who desire to take dairy bacteriology as a part of a minor for the doctorate should register in bacteriology according to the regulations given under bacteriology on page 27.

Courses for Graduates

101. Economic Milk Productions.—Efficiency of dairy farms; factors influencing profits. *Twice a week; both semesters. One unit.* Professor Fraser

104. Scientific Readings.—German or French bacteriological text. Recommended for first-year and second-year students. *Once a week; both semesters. One-half unit.* Professor Harding, Assistant Professor Prucha

105. Bacteriological Literature.—Each student is required to prepare and deliver an acceptable course of lectures. (Recommended for second-year and third-year men). *Once a week or once in two weeks; both semesters. One-half or one unit.* Professor Harding

106. Research on Assigned Problems.—(Open to graduate students whose development permits their undertaking problems of dairy bacteriology with only general supervision.) *Both semesters. One-half unit to two units.* Professor Harding, Associate Professor Prucha

107. Dairy Chemistry.—Assigned problems. *Once a week. Both semesters One unit.* Dr. Overman

Courses for Graduates and Advanced Undergraduates

11. Daily Bacteriology.—Bacteria in milk and its products; sources, effect on milk, and method of control. *Twice a week; first semester.* (Not given, 1918-19.) Professor Harding

12a–12b. Dairy Bacteriology.—Laboratory work supplementing Dairy Husbandry 11. *Four times a week; both semesters.* (Not given, 1918-19.) Professor Harding, Mr. Brew

20. Economic Problems in Dairy Farming.—*Three times a week; first semester.* Professor Fraser

21. Economic Milk Production.—*Five times a week; second semester.* Professor Fraser

ECONOMICS

Every student entering on major graduate work in economics must have had a course in the principles of the science and also in some special part of the field such as public finance or money and banking. The work must represent at least eight semester hours. He must also have had at least one semester's work in English, American, or general European history; and at least three hours in political science.

Those who take the subject as a minor must have had a course of at least five semester hours in the principles.

Graduate students who are making economics their major are required during their first year to acquaint themselves with the works of the masters in the science, either by taking course 101 or by private reading for examination. In the second or third year they are expected to elect courses 105 and 120, and some fundamental course in political science and sociology unless they have already had such courses.

The following courses may be taken by students in general economics for major or minor credit: all numbered above 100; 4, 5, 10, 12, 13, 19, 20, 21, 29. 51. The following may be taken for minor credit only: 8, 9, 14, 15, 17, 28, 31.

Two units will be accepted for a first minor for the master's degree; and four two or three hour graduate courses, or their equivalent in advanced undergraduate courses, for a first minor for the doctor's degree.

Courses in transportation may be included in their programs by students of economics as part of either their major or minor subjects. See Transportation.

Courses for Graduates

101. Economic Theory.—*Twice a week; both semesters. One unit.* [For 1918-19 consolidated with No. 21 as 21W.] Professor Kinley

104. Foreign Commerce.—*Twice a week; both semesters. One unit.* Assistant Professor Litman

105. Public Finance.—*Twice a week; both semesters. One unit.* Professor Bogart

107. The Corporation in Economic Evolution.—*Twice a week; both semesters. One unit.* Professor Robinson

109. Theory of Industrial Consolidation.—The nature, causes, and effects of industrial consolidations; prices, profits, and wages. *Twice a week; both semesters. One unit.* (Not given, 1819-19.) Professor Robinson

110. Investments.—Nature, character, and function of investments; classes including direct investment and securities of various types; methods of judging investments; state control. *Twice a week; both semesters. One unit.* Professor Robinson

118. Seminar.—Bi-weekly discussion of the results of students' investigations. Members of the staff

122. Advanced Economic History of the United States.—*Twice a week; both semesters. One unit.* (Not given, 1918-19. See Economics 19.) Professor Bogart

Theory of Statistics. See Mathematics 129.

Courses for Graduates and Advanced Undergraduates

5. Public Finance.—Public debts, revenue, taxation, etc. *Three times a week; first semester.* Dr. Hunter

8. The Money Market.—*Twice a week; second semester.* Assistant Professor Weston

9. Practical Banking.—*Twice a week; first semester.* Assistant Professor Weston

10. Corporation Management and Finance.—*Three times a week; second semester.* Professor Robinson

11. Industrial Consolidation.—Development; plans for controlling trusts. *Three times a week; first semester.* Professor Robinson

12. Labor Problems.—*Three times a week; both semesters.* Dr. Watkins

13. Economic Development of Europe Since the Industrial Revolution. —*Three times a week; second semester.* (Not given, 1918-19.)
Professor Bogart

19. Economic History of the United States, 1820-1860.—*Twice a week; first semester.* Associate Professor C. M. Thompson

21. Socialism and Economic Reform.—*Twice a week; second semester.* [Consolidated with 101 for 1918-19. See 121.] Professor Kirby

21Wa–21Wb. Economic Foundations of Society.—Owing to consolidation of courses necessitated by the conditions of war, Economics 21 and Economics 101 are combined for the current University year as Economics 21W. The course treats of theories of the economic organization of society; of theories of the organization, production and distribution of wealth; and of proposed schemes of social reconstruction, whose aim or method or fundamental justification is a better economic order. The latter part of the course deals with specific proposals of socialism,—"utopian," "scientific" and "opportunist"; and also with economic reorganization caused by the war and economic reconstruction afterwards. *Twice a week; both semesters.* Professor Kinley

28. Mechanism and Technique of Domestic Commerce.—*Three times a week; first semester.* Assistant Professor Litman

29. International Trade and Trade Policies.—*Twice a week; second semester.* Assistant Professor Litman

31. Organization of Foreign Commerce.—Exporting and importing; means of communication and of transportation; the shipping business; duties of consuls. *Three times a week; second semester.* Assistant Professor Litman

EDUCATION

Students who elect education as a major subject must have completed at least a three-hour course in the principles of education, a course of at least the same length in the history of education, and a minimum of three hours each in psychology and philosophy. For graduate students who have had experience in teaching, these requirements may be modified.

Courses for Graduates

101. Seminar in Educational Theory.—*Once a week, two hours; first semester. One unit.* Professor Bode

106. Seminar in Secondary Education.—Organization, administration, and special methods of secondary education. *Once a week, two hours; second semester. One unit.* Professor.....

110. Seminar in Methods of Teaching.—Individual investigations of problems of technique. *Once a week; two hours; first semester. One unit.*
Professor Charters

112. Principles of Education.—(For graduate students who are not majoring in education and who have not taken undergraduate courses in education.) The American public-school system; principles and doctrines of educational science; technique of teaching and problems of class management. *Twice a week; second semester. One-half unit.* Professor .....

119. The Elementary Curriculum.—*Twice a week; second semester. One unit.* Professor Charters

125. Seminar in Educational Psychology.—*Once a week, two hours; first semester. One unit.* Professor Whipple

Departmental Conference.—Every alternate Monday from 7 to 9 p. m. All graduate students majoring in education are expected to meet with the departmental staff at this time. The work carries no credit. *First and second semesters.*

Courses for Graduates and Advanced Undergraduates

4. Problems of Educational Administration.—Interpretation of present tendencies. *Three times a week; first semester.* Assistant Professor Stevenson

5. Comparative Education.—Educational organization, administration and basic national ideals of the schools and school systems of the United States, Germany, England and France; secondary education and the training of teachers. *Three times a week; first semester.* Professor.....

6. Principles of High-School Education—*Three times a week; first semester.* Professor .....

13–14. Educational Classics.—Educational writings of Plato, Aristotle, Quintilian, Montaigne, Milton, Locke, Comenius, Rousseau, Pestalozzi, Froebel, and Herbert Spencer. *Three times a week; first and second semesters.* Mr. O'Gorman

15. School Hygiene.—*Twice a week; second semester.* Professor.....

18. Method in Educational Research.—*Twice a week; first semester.* Professor.....

19. Readings in French and German Educational Literature. *Twice a* Professor.....

20a. Theory of Supervision.—*Three times a week; first semester.* Professor Charters

27. High School Curriculums.—*Three times a week; first semester.* Professor.....

41. Vocational Education.—*Three times a week; first semester.* Professor.....

42. Auxiliary Education.—Training of defectives and delinquents; the Binet-Simon tests and other methods of mental diagnosis; educational treatment of morons and of moral delinquents; methods of teaching sensory defectives (the blind and the deaf); public institutions of auxiliary education and their administration. *Three times a week; second semester.* Professor.....

43. Mental Tests.—Laboratory drill; tests of sensory capacities; attention; memory; learning; suggestibility; inventiveness; system of tests for diagnosis of mental age, general intellectual status, mental retardation, etc. *Twice* Professor.....

45. Research Problems in Educational Psychology.—*Either semester.* Professor.....

ELECTRICAL ENGINEERING

The prerequisite for graduate work in electrical engineering is the equivalent of the undergraduate courses required for the degree of Bachelor of Science in electrical engineering in the branches of the subject in which registration is desired.

Graduate students who wish to take a minor in electrical engineering must have had differential and integral calculus, and one year's work in college physics.

*Courses for Graduates**

101. Advanced Course in Alternating Currents.—The theory of transient phenomena; polyphase circuits; measuring apparatus. *Twice a week; both semesters. One and one-half units.* Professor Paine

103. Electrical Design.—Plans for an electrical machine or apparatus of specified character; or for the arrangement of an electrical plant; or for the installation of such machinery or apparatus. *Twice a week; second semester. One unit.* Assistant Professor Waldo

104. Telegraphy and Telephony.—Telegraph apparatus and methods including quadruplex systems and high speed telegraphy. Manual and automatic telephone systems. *Once a week; either semester. One unit.* Professor Brooks

105. Electrical Engineering Research.—Investigation of electrical phenomena, or test of some electrical machine, or of a plant of such machines. *Twice a week; both semesters. One to three units.* Professor Paine

106. Illumination.—Problems in illumination; light sources. *Once a week; both semesters. One unit.* Professor Brooks

ENGLISH LANGUAGE AND LITERATURE

Students who enter on graduate work with English as their major subject are required to give evidence of their ability to write good English. They must present the equivalent of fourteen hours of undergraduate work in English literature, the required college work in rhetoric, and the equivalent of four semesters of college work in a language other than English. After the first year of graduate work a knowledge of French and German is indispensable.

Students making English their minor may be admitted to such courses as in the judgment of the instructor in charge they are qualified to pursue.

The Degree of Master of Arts in English.—In addition to complying with the general rules of the Graduate School, candidates for the degree of Master of Arts in English must comply with the following rules of the Department of English: (1) they must choose a portion of their work from the group of courses described as "for graduates"; (2) must offer an elementary course in Anglo-Saxon; and (3) must take, besides the regular semester examinations in all their courses, a general examination, oral or written as the department may prescribe, which shall be a final test of the candidate's fitness and ability.

The Degree of Doctor of Philosophy in English.—Candidates for the degree of Doctor of Philosophy in English may expect to be examined on the entire field

*Courses offered to Junior and Senior students are open for minor credit to students majoring in other fields.

of the English language and literature. They are urged, furthermore, to acquaint themselves as fully as possible with the history and philosophy of the period in which their main interest lies, and with the foreign languages and literatures most closely related to English in that period.

Courses for Graduates

101. Research in Special Topics.—Guidance in writing theses for advanced degrees. *From one to two units.* Professor Sherman, Professor Dodge, Professor Bernbaum, Associate Professor Paul, Assistant Professor Baldwin, Assistant Professor Scott, Assistant Professor Jones, Assistant Professor Zeitlin, Visiting Professor Woodbridge.

110. Old English (Anglo-Saxon) Poetry.—*Twice a week; first semester. One unit.* Professor Dodge

112. The History of the English Language.—*Twice a week; both semesters. One unit.* (Not given, 1918-19.) Assistant Professor Zeitlin

114. The Development of the Essay.—The English essay; continental influences; classical origins. *Twice a week; both semesters. One unit.* Assistant Professor Zeitlin

120. The History of English Criticism.—Critical standards from Aristotle to Sainte-Beuve. The main types of criticism. *Twice a week; both semesters. One unit.* Visiting Professor Woodbridge

126. Ballads.—Studies in the relation of folk poetry to literature. *Twice a week; first semester. One unit.* Dr. Schoepperle

127. Metrical Romances.—The beginnings of verse fiction. *Twice a week; second semester. One unit.* Dr. Schoepperle

128. Spencer and the Beginnings of the English Renaissance.—The persistence of certain medieval traditions reinforced by the Revival of Classical Learning; Catholicism and Calvinism as sources of literary inspiration. *Twice a week; both semesters. One unit.* Assistant Professor Jones

129. English Literature from Norman Conquest to Chaucer.—Middle English authors exclusive of Chaucer. *Twice a week; both semesters. One unit.* (Not given, 1918-19.) Assistant Professor Jones

135. Problems in American Literature:—Poe, Lowell: *Twice a weeks both semesters. One unit.* Associate Professor Paul

136. The Transition from the Seventeenth to the Eighteenth Century, 1675-1725; the Rise of Classicism.—*Twice a week; both semesters. One unit.* (Not given, 1918-19.) Associate Professor Paul

137. Prose Writers of the Nineteenth Century.—Relation of literature to social forces; Mill, Carlyle, Newman, Ruskin, Arnold, and Pater. *Twice a week; both semesters. One unit.* (Not given, 1918-19.) Professor Sherman

138. The Romantic Movement in England.—*Twice a week; both semesters. One unit.* Professor Sherman

140. Investigations in Modern English Literature.—(For second-year and third-year graduate students who are preparing theses for the doctor's degree.) *Three hours once a week; both semesters. One to three units.* (May be taken in successive years.) Professor Bernbaum

141. The History of Seventeenth Century English Literature to About the Year 1675.—Poetry, beginning with Shakspere's Sonnets. *Twice a week; both semesters. One unit.* (The first semester may not be taken separately.)
Professor Bernbaum

142. The Conflict of Ideas and Ideals in Eighteenth Century Literature.—*Twice a week; both semesters. One unit.* (Not given, 1918-19.)
Professor Bernbaum

143. The Origins of the English Novel, and Its History to the End of the Eighteenth Century.—*Twice a week; both semesters. One unit.* (The first semester may not be taken separately.) Professor Bernbaum

144. Lincoln's Letters and Speeches.—Development of style, relation to period, textual study, contemporary estimates. *Twice a week; second semester. One unit.* Professor Dodge

Courses for Graduates and Advanced Undergraduates

A. English Literature and Language

3. The Poetry of Milton.—Origins, forms, artistic and ethical values; Milton's place in English literary history. *Twice a week; second semester.*
Assistant Professor Baldwin

4. English Versification.—Verse forms; reading of representative poems. Verse composition; individual conferences. *Three times a week; first semester.*
Dr. Creek

5. Shakspere.—Six plays, with special emphasis on *Hamlet. Three times a week; second semester.* Professor Dodge

8–9. Old English (Anglo-Saxon.)—Grammar; prose; short poems; *Beowulf.* (The first semester may be taken separately.) *Three times a week; both semesters.* Professor Dodge

16. Development of English Prose.—Prose style from the year 1500 onward; classical and French influences. *Prerequisite: credit for either entrance or college Latin or French. Three times a week; second semester.* (Not given, 1918-19.) Assistant Professor Zeitlin

18. Modern English Grammar.—Sentence structure and analysis; grammatical categories; peculiarities of English syntax. *Three times a week; second semester.* Assistant Professor Zeitlin

25. Chaucer.—*Three times a week; first semester.*
Assistant Professor Jones

27–28. Studies in the Relations of Journalism and Literature.—*First semesters*: English Literary Periodicals and the genesis and evolution of the Periodical Essay in the 17th and 18th Centuries. *Second semester*: The Magazine in America. *Twice a week; both semesters.*
Assistant Professor Scott

35–36. English Drama (exclusive of Shakspere).—*First semester*: From the beginning to 1600. *Second semester*: From 1600 to 1700. (Either semester may be taken separately.) *Three times a week; both semesters.*
Professor Dodge, Visiting Professor Woodbridge

37. Folk Lore.—Primitive customs and beliefs surviving in English poetry;

folk lyric and drama; early satire and gnomic literature. *Twice a week; first semester.* Dr. SCHOEPPERLE

38. THE ARTHURIAN TRADITION.—The historical Arthur; Celtic influences; Old French Romances (in translation); the tradition in England to the present time, with especial attention to Malory and Tennyson. *Twice a week; second semester.* Dr. SCHOEPPERLE

39. INTRODUCTION TO THE LITERATURE OF THE MIDDLE AGES.—Classical influences. Principal types: epic, romance, legend, lay, allegory, fabliau, lyric. Important poems, both English and continental, will be read in translation. *Three times a week; second semester.* Dr. CREEK

41. THE TEACHING OF ENGLISH LITERATURE.—Methods of teaching English literature in the high school. *Twice a week; first semester.* Associate Professor PAUL

42. THE TEACHING OF ENGLISH COMPOSITIONS.—Methods of teaching English composition in the high school. *Twice a week; second semester.* Associate Professor PAUL

45. THE DEVELOPMENT OF THE MODERN DRAMA.—Dramatic tendencies in the Nineteenth century, both in England and on the Continent. *Three times a week; first semester.* Visiting Professor WOODBRIDGE

52. THE GREAT NOVELISTS OF THE NINETEENTH CENTURY.—Scott, Jane Austen, Dickens, Thackery, Hawthorne, George Eliot, Meredith, Hardy, Stevenson. *Three times a week; second semester.* Professor BERNBAUM

53. MATTHEW ARNOLD.—His prose and poetry with special reference to the main currents of nineteenth century thought. *Three times a week; second semester.* Professor SHERMAN

54. INTRODUCTORY AND COMPARATIVE SURVEY OF THE GREATEST GREEK, LATIN, ITALIAN, SPANISH, FRENCH, GERMAN, AND ENGLISH AUTHORS. *Three times a week; both semesters.* Professors OLDFATHER, OLIVER, FITZ-GERALD, LESSING, and BERNBAUM, and Dr. VAN HORNE.

The second semester may not be taken separately.

The assigned reading may be done in translations.

PLAN OF LECTURES

Sept. 20-Nov. 15. Greek and Latin Authors. Professor OLDFATHER

Nov. 15-Jan. 25. Italian and Spanish Authors. Professors OLIVER and FITZ-GERALD

Feb. 10-Mch. 20. French Authors. Professor OLIVER

Mch. 20-Apr. 20. German Authors. Professor LESSING

Apr. 20-May 29. English Authors. Professor BERNBAUM

60a–60b. THESIS.—Special training in investigation for candidates for honors and for other seniors. *Once a week; both semesters.* Assistant Professor ZEITLIN, and others

B. CELTIC

The following courses are open to Juniors, Seniors, and Graduate Students without prerequisite. Celtic 1 is not prerequisite for Celtic 2. Neither may be counted toward a major in English.

1. Celtic Civilization—Social life in ancient Ireland. Survivals of custom and belief in Scotland and Wales. Celtic literature and folk-lore as reflecting Celtic life. *Twice a week; first semester.* Dr. Schoepperle

2. Celtic Literature in English Translation.—The Cuchullin and Ossianic Romances, the Mabinogion, Bardic poetry, Voyages, etc. The Irish Renaissance. *Twice a week; second semester.* Dr. Schoepperle

C. Rhetoric

15–16. Editorials and Special Articles.—The larger problems in journalistic writing; relation of history, economics, and political science to current events; editorial and feature writing. *Three times a week; both semesters.* Assistant Professor Scott

17. Advanced Composition.—Practise writing, with special emphasis on structure; criticism of current periodical literature; development of material for reports, magazine articles, etc. (Open to a limited number of students, and only on recommendation.) *Three times a week; second semester.* Mr. Weirick

D. The Scandinavian Languages

Preparation for major graduate work in the Scandinavian languages or literature must include a good knowledge of one of the Scandinavian languages and systematic work in the undergraduate courses in Scandinavian. Any graduate student in language may, however, be admitted to the purely philological courses.

Courses for Graduates

101. Old Norse.—Introduction to the language. Reading of the *Prose Edda. Twice a week; both semesters. One unit.* Associate Professor Flom

103. Old Swedish.—Noreen's grammar and reader is used. *Twice a week; second semester. One unit.* Associate Professor Flom

110. Advanced Old Norse.—Lays of the *Elder Edda* and selections from the *Speculum Regale* (*Konungs Skuggsjà*). *Twice a week; both semesters. One unit.* (Not given, 1918-19.) Associate Professor Flom

140. Early Scandinavian Paleography.—(The work is based on the facsimiles and photographs of manuscripts in the Scandinavian Collection of the University library.) *Twice a week; second semester. One unit.* (Not given, 1918-19.) Associate Professor Flom

150. Research.—Special problems in Scandinavian philology or literature. *Twice a week; first semester. One to two units.* Associate Professor Flom

Courses for Graduates and Advanced Undergraduates

14. History of Old Norse Literature.—The mythical lays, the court poetry, the sages, the ballads. *Twice a week; first semester.* Associate Professor Flom

16. Introduction to the History of Early Scandinavian Culture.—The civilization of Scandinavia from the Stone Age down to the close of the Viking Age, 1000 A. D. *Twice a week; second semester.* (Not given, 1918-19.) Associate Professor Flom

ENTOMOLOGY

The prerequisite for graduate work in entomology is two years of undergraduate biology, of which one year should be zoology. Entrance on major work in entomology requires entomology 15 or its equivalent. A reading knowledge of French and German is necessary at least by the beginning of the second year.

Courses for Graduates

102. Research in the Morphology and Embryology of Insects.—*Twice a week; both semesters. One or two units.* Assistant Professor Folsom

108. Research in Economic Entomology.—*Once or twice a week; both semesters. One or two units.* Assistant Professor Folsom

109. Research in Systematic Entomology.—*Two times a week; both semesters. One or two units.* Professor MacGillivray

Courses for Graduates and Advanced Undergraduates

10. Taxonomy of Immature Insects.—External form of immature insects; identification of species. *Three times a week; both semesters.* Professor MacGillivray

11. Classification of the Coccidae.—Preparing scale insects for study; identification of genera and species; morphology, metamorphosis, and phylogeny. *Five times a week; second semester.* Professor MacGillivray

12. Current Literature.—*Once a week; both semesters.*

15. Introductory Course.—Metamorphosis and development of insects; orders, suborders, and families; habits of species; anatomy of immature and adult insects; special adaptive structures; classification of insects. *Three times a week; first semester.* Professor MacGillivray

17. Insect Organogeny.—Adult and immature insects. *Three times a week; both semesters.* Professor MacGillivray

18. Insect Taxonomy.—Structures used in the classification of insects; identification of a representative collection of insects. *Five times a week; both semesters.* Professor MacGillivray, Dr. Mosher

FRENCH

(See Romance Languages)

GENETICS

Instruction in courses leading to advanced degrees in genetics is offered by the departments of agronomy, animal husbandry, botany, horticulture, and zoology. The work is offered under the supervision of a committee representing these departments.

The prerequisites for major work in genetics are Botany 1 and 3a, Mathematics 2 and 4, and Zoology 1 and 2, or their equivalents. A reading knowledge of German and French is indispensable.

The prerequisite for minor work in genetics is 10 hours of botany or zoology.

Courses for Graduates

Agronomy

112. Plant Breeding.—Experiments at this station; methods and results reported from other states and from foreign countries. *Twice a week; both semesters. One to two units.* Professor Smith

Animal Husbandry

117. Genetic Experiments on Animals and Plants.—Biological and mathematical methods employed; the validity of the conclusions. *Two to five times a week; both semesters. One to two units.* Associate Professor Detlefsen

112e. Research.—Experimental investigations in heredity and variation. (This course may be taken during the summer by special permission.) *Once a week; both semesters. One to two units.* Associate Professor Detlefsen

Botany

101. Individual Plant Development.—Origin of the individual; external and internal factors in its development and physiologic performance; response of the cell, somatic and generative, to external factors. *Once a week; both semesters. One to two units.* Professor Hottes

Zoology

115. Factors of Individual and Racial Development.—Experimental embryology; regeneration; heredity; variation; evolution. *Twice a week; both semesters. One unit. Time to be arranged.* Professor Zeleny

124. Experimental Zoology.—Individual research course. *Both semesters. One to two units. Time to be arranged.* Professor Zeleny

Courses for Graduates and Advanced Undergraduates

Agronomy

22. Plant Breeding.—The improvement by breeding of field crops, including grains, grasses, and legumes. With practical applications. *Twice a week; second semester.* Professor Smith

Animal Husbandry

30. Genetics.—Heredity, variation, elements of biometry, and their practical application to breeding. *Five times a week; second semester.* Associate Professor Detlefsen

Botany

14a–14b. Heredity, Variation, Evolution.—Cells and members of plants; adaptations and changes; mechanism of heredity; evolution. *Twice a week; both semesters.* Professor Hottes

Horticulture

12. Evolution of Horticulture Plants.—History, botanical calssification, and geographical distribution of cultivated plants; modification under culture; variation. *Three times a week; first semester.* Professor Crandall

Zoology

25–26. Experimental Zoology.—Experimental embryology; regeneration; heredity; variation; evolution. *Two to five times a week; both semesters.*

(See also Mathematics 129; Zoology 8, 20.) Professor Zeleny

GEOLOGY

For graduate work in geology the student must have a sound elementary training in the general principles of the science, and must have done advanced work in at least one of its branches. Except in unusual cases, which will be decided on their merits, at least 20 hours of geology and two weeks or more of field experience will be required. Graduate students with adequate technical preparation in other sciences may be admitted to graduate courses in certain subjects, such as crystallography.

Under the present organization of the department, major fields of study for the doctorate will normally be: (a) historical geology, including sedimentation; (b) stratigraphy and paleontology; (c) economic geology, including mineralogy and petrology. First or second minor subjects are available as follows, except that in no case may the minor subject belong to the more comprehensive field in which the major is selected: (a) physiography; (b) stratigraphy; (c) paleontology; (d) historical geology; (e) sedimentation; (f) petrology; (g) economic geology; (h) mineralogy and crystallography (limited to students who are not majoring in geology).

A first minor presupposes 4 units, and a second minor 2 units credit.

Courses for Graduates

101. Advanced Crystallography.—The methods used in measuring, projecting, and calculating crystal forms, and determining the physical properties of crystallized bodies. *Twice a week; both semesters. One unit.*

Professor Bayley

102. Igneous Petrography.—The igneous rocks; identification of types, classification, and relationships. *Twice a week; first semester. One unit.* (Not given, 1918-19.)

Professor Bayley

103. Metamorphic Petrography.—Microscopy of the metamorphic rocks; interpretation of their origin. *Twice a week; second semester. One unit.*

Professor Bayley

105. Paleontologic Problems.—Fossil invertebrates by zoological or faunal groups. *One to three times a week; both semesters. One unit.*

Associate Professor Savage

108. Ore Deposition.—Origin of ore deposits, as illustrated by selected mining districts. *Three times a week; both semesters. One unit.*

Professor Bayley

125. Sedimentation.—The interpretation of sedimentrry rocks in terms of their origin. *Once a week; both semesters. One unit.* (Not given, 1918-19.)

Professor Blackwelder

126. Historical Problems.—*Once a week; both semesters. One unit.*

Professor Blackwelder

130. Field Research.—Investigation of the geology or geography of an approved district, under general supervision of a member of the department faculty. Weekly reports. S; (*One-half to three units*).

Professor Blackwelder, Professor Bayley, Associate Professor Savage

135. Research.—Individual work under the supervision of members of the staff in their respective fields. *Once a week; both semesters and summer. One to four units.* Professors Blackwelder, Bayley, Associate Professor Savage, Dr. Rich.

136. Seminar in Physical Geology.—Special problems in mineralogy, petrography, economic geology, metamorphism, and related subjects. *Once a week; both semesters. One unit.* Professor Bayley

137. Seminar in Historical Geology.—Historical geology, paleontology, correlation, and allied subjects. *Once a week; both semesters. One unit.* (Not given, 1918-19.) Professor Blackwelder and Associate Professor Savage

138. Physiographic Problems.—Advanced problems in physiography, with introduction to research methods. *Once a week; both semesters. One unit.* Dr. Rich

Courses for Graduates and Advanced Undergraduates

6. Optical Mineralogy.—An introduction to the courses in petrography. *Twice a week; first semester.* Professor Bayley

7. Petrography.—The principles learned in course 6 are applied to the study of rocks. *Once a week; second semester.* Professor Bayley

15. Structural Geology.—*Three times a week; first semester.*

16. Stratigraphy.—The sequence of rock formations in North America, and their index fossils. *Five times a week; second semester.* Associate Professor Savage

17. Earth History.—Physical conditions and events in the geological periods, with special reference to North America. *Three times a week; first semester.* Professor Blackwelder

23. Physiography of the Lands.—The making of topographic features as controlled by such factors as climate, and rock structure. Physiographic history. Two Saturday field trips. *Twice a week; second semester.* Dr. Rich

24. Physiographic Interpretations.—The application of physiographic principles to the interpretation of recent earth history. *Twice a week; first semester.* Dr. Rich

31. Geology of Oil and Gas.—Origin and relations of the natural hydrocarbons: their distribution both geographically and in the stratigraphic column. *Three times a week; second semester.* Dr. Tomlinson

41. Summer Field Survey.—For 1918 the field will probably be Eastern Wyoming. Eight weeks in summer. Party limited to 10, approved in advance. Professor Blackwelder

42. Stratigraphic Paleontology.—The invertebrate index fossils of the successive geologic formations, from the Cambrian to the Tertiary. *Three times a week; both semesters.* Associate Professor Savage

45a-45b.—Geological Conference.—All members and advanced students of the department participate in this for the purpose of considering the results of investigations, reviews of important publications, and special lectures. Credit given only to those advanced students authorized to register for the course. *Once a week; both semesters.* Professor Blackwelder

GERMANIC LANGUAGES AND LITERATURE

German

Students desiring to take German as a major are required to have finished successfully a four years' course of undergraduate work in German, comprising a minimum of twenty-eight semester hours of credit. They are also required to be familiar with the principal works of the writers of the classical and modern periods of German literature, to show a general knowledge of the history of German literature, and to be able to follow lectures in the German language.

Of collateral subjects, a reading knowledge of Latin and French is required. It is desirable that candidates for the degree of Ph.D. have some knowledge of Greek. All students are to have had a course in German history.

Courses for Graduates

101. Seminar in Germanic Philology.—Training in original research. Results, when of value, may be published in the *Journal of English and Germanic Philology. Once a week; both semesters. One unit.* Professor Goebel

103. Introduction to the Historical Study of the Germanic Languages.—History of German philology; comparative grammar of the old Germanic dialects. *Twice a week; second semester. One unit.* Professor Goebel

104. Gothic.—Grammar and literature. *Twice a week; first semester. One unit.* Professor Goebel

105. Old High German.—Grammar and interpretation of the oldest literary documents. *Three times a week; second semester. One unit.* Dr. Williams

109. Goethe's and Schiller's Philosophy.—*Twice a week; both semesters. One unit.* Professor Goebel

110. Early German Drama.—German drama up to the Reformation: medieval religious drama, Shrovetide plays, beginnings of the humanistic drama. *Twice a week; first semester. One unit.* Assistant Professor Brooks

113. German Literature of the Fifteenth and Sixteenth Centuries.—Luther and the Reformation, Mastersingers and Folksong, the Reformation drama. Hans Sachs, Brant, Fischart, the chap books, the English comedians. *Twice a week; second semester. One unit.* Assistant Professor Brooks

115. History of German Literature During the Nineteenth Century.—*Twice a week; both semesters. One unit.* Professor Lessing

116. Medieval German Literature with Reference to Political, Religious, and Social History.—Research course. *Twice a week; both semesters. One unit.* (Not given, 1918-19.) Professor Lessing

117. History of German Literature During the Eighteenth Century.—*Twice a week; both semesters. One unit.* Professor Goebel

118. The German Drama Since Schiller.—Research course. *Twice a week; both semesters. One unit.* Professor Lessing

119. The German Novel.—Research course. *Twice a week; both semesters. One unit.* (Not given, 1918-19.) Professor Lessing

121. Walther von der Vogelweide.—*Twice a week; second semester. One unit.* (Not given, 1918-19.) Professor Goebel

121b. Nibelungenlied.—*Twice a week; second semester. One unit.* Professor Goebel

125. History of the German Language.—Evolution of the forms, syntax, and lexicography of the High German literary language. *Three times a week; second semester. One unit.* (Not given, 1918-19.)

Courses for Graduates and Advanced Undergraduates

8. Schiller.—The life of Schiller; *Wallenstein* and other selections. *Three times a week; second semester.* Professor Lessing

19a–19b. Goethe's Faust.—The Faust legend and early Faust books and plays; the genesis of Goethe's *Faust;* reading of both parts. *Twice a week; both semesters.* Professor Goebel

26a. German Literature to the End of the Reformation.—*Three times a week; first semester.* Professor Lessing

26b. German Literature after the Reformation.—*Three times a week; second semester.* Professor Lessing

27. Lessing.—The life of Lessing; *Nathan der Weise, Emilia Gallotti* and other selections. *Three times a week; first semester.* Professor Lessing

29. Advanced Prose Composition.—Themes on Germany and German life, based on suitable reading, discussed in German. *Three times a week; both semesters.*

31. Middle High German.—*Twice a week; first semester.* Professor Goebel

32. History of Germanic Civilization.—*Three times a week; first semester.* Assistant Professor Brooks

GREEK

(See Classics)

HISTORY

Graduate work in history requires two years of college work in this subject, or sixteen semester hours, which should ordinarily include introductory courses in European and American history. Linguistic preparation is important especially in French and German. For medieval history some knowledge of Latin is essential, and Spanish is useful for certain fields of American history.

Advanced courses in history at the University of Illinois are of three kinds: (1) Courses for information and guidance in general reading. (2) Instruction in methodology, historiography, and bibliography. A part of this work (in course 103) is required of all graduate students in history during their first year. (3) Seminar courses for the study of special fields with a view primarily to training in the methods of historical criticism and research.

Illinois Historical Survey.—Historical students have an opportunity to pursue research in western history in connection with the Illinois Historical Survey, which is an organization for the purpose of carrying on systematic studies in the history of Illinois.

Attention is also called to the fact that the University of Illinois has for some time cooperated with the Trustees of the State Historical Library in the gathering and editing of archive material. As a result of this relation instructors and graduate students in the department have contributed from time to time to the publications of the Library and have been given useful training in the study of manuscript as well as printed material.

Higher Degrees in History. The following statement regarding the specific requirements for higher degrees in history is subject to the general requirements of the Graduate School.

Master of Arts

In addition to meeting the general tests in the specific courses taken, each candidate is required to pass a general oral examination, and written examinations in two of the following fields: ancient history; medieval history of continental Europe; modern history of continental Europe; English history; American history. Candidates for this degree are expected to have a general knowledge of historical bibliography and methodology (see course 103.)

Doctor of Philosophy

Major Requirements.—A candidate who selects history as his major subject may offer himself for examination in any four of the fields indicated below, stating also the particular field among these four in which he wishes to specialize and in which his thesis is to be written:

1. Ancient history. 2. Medieval history and institutions of continental Europe, to the close of the thirteenth century. 3. Continental Europe from 1300 to 1648. 4. Continental Europe and its dependencies since 1648 (except as included in 5 and 6.) 5. The history of England and its dependencies (not including America before 1783). 6. American history (except as included in 5, and with primary reference to the United States). This enumeration of fields is not to be regarded as excluding the possibility of accepting others as may be determined by the department in individual cases.

Minor Subjects.—A candidate for the doctorate in history may select as his first minor one of the divisions of the field of history listed above which is not offered as a part of his major. He should preferably, however, select his minors from subjects offered by other departments. The following list of suitable minors is intended to be suggestive rather than exhaustive or compulsory.

I. In Political Science.—(Any two acceptable for a first minor; any one, for a second minor): 1. International law and diplomacy. 2. Modern government. 3. Municipal government. 4. Constitutional and administrative law and jurisprudence. 5. Political theory.

II. In Economics and Sociology.—Any two acceptable for a first minor; any one, for a second minor: 1. Economic history. 2. Economic theory. 3. Public and private finance. 4. Social reform. 5. Principles of sociology.

III. In Philosophy and Education.—(Any two acceptable for a first minor; any one, for a second minor): 1. History of ancient and medieval philosophy. 2. History of modern philosophy. 3. History of education.

IV. In Literature.—Some division of the history of literature which may be either comparative literature of a limited period or the literature of a particular country for a more extended period as may be agreed on in each case.

Courses for Graduates

101. Seminar in American History.—Bibliography; practise in the solution of typical problems which will be chosen this year with special reference to

the international relations of the United States; reports on the progress of individual investigations by instructors and students. *Two hours, once a week; both semesters. One to two units.* Professor GREENE and others

In connection with this course, advice and direction in research are offered in various fields as follows:

A. American history before 1815. Professor GREENE

B. American history since 1815.
Assistant Professor ROBERTSON, Assistant Professor COLE

C. The history of the west. Professor ALVORD

D. American church history. Professor GREENE

E. Latin-American history. Associate Professor ROBERTSON

102. STUDIES IN ENGLISH HISTORY.—Church and state in the medieval and early modern period; examination of documentary material. *Arrange hours; both semesters. One unit.* Professor LARSON

103. HISTORIOGRAPHY AND HISTORICAL METHOD.—The technique of historical investigation. Required of all candidates for an advanced degree in history who do not present evidence of similar training elsewhere. *Twice a week; first semester. One-half unit.* Assistant Professor COLE

104. SEMINAR IN ENGLISH AND CONTINENTAL EUROPEAN HISTORY.—European expansion. Bibliography, historiography, and selected problems; reports. *Two hours, once a week; both semesters. One to two units.*
Professor LARSON, Professor LYBYER, and Dr. JONES

In connection with this course, advice and direction in research in various fields are offered as follows:

A. Medieval history. Professor LARSON

B. Modern history of continental Europe. Professor LYBYER

C. English history. Professor LARSON

D. Renaissance and Reformation. Dr. JONES

E. Asiatic Relations. Professor GREENE, Professor LYBYER

105. STUDIES IN THE HISTORY OF THE WEST.—The special subject for 1918-19 will be: French Colonization of the Mississippi Valley. *Once a week; both semesters. One unit.* Professor ALVORD

11. SPANISH-AMERICAN RELATIONS.—The relations of the Latin-American States with Europe and the United States; the Monroe doctrine; the development of international trade, etc. *Once a week; both semesters. One-half to one unit.* Associate Professor ROBERTSON

112. STUDIES IN AMERICAN RELIGIOUS HISTORY.—Questions of Church and State. *Twice a week; second semester. One unit.* Professor GREENE

114. STUDIES IN AMERICAN CONSTITUTIONAL HISTORY.—Colonial institutions on the eve of the Revolution; transition from provincial to republican government; genesis of the Federal Constitution; selected topics in the development of the Constitution since 1789. *Twice a week; both semesters.* (Not given, 1918-19.) Professor GREENE, Associate Professor ROBERTSON

150. RESEARCH IN ORIENTAL HISTORY.—*Both semesters. One unit.*
Professor OLMSTEAD

Courses for Graduates and Advanced Undergraduates

4a–4b. CONSTITUTIONAL HISTORY OF ENGLAND.—Institutional origins; modern constitutional practise. *Three times a week; both semesters.*
Professor LARSON

9a–9b. EUROPEAN SOCIETY IN THE ERA OF THE RENAISSANCE AND THE REFORMATION.—The transition from medieval to modern ideals. *Twice a week; both semesters.* Dr. JONES

11. SPECIAL TOPICS IN ANCIENT HISTORY.—Methods of research in Greek and Roman history. *Three times a week; second semester.*
Professor OLDFATHER

13. THE AMERICAN REVOLUTION, 1760-1783.—Colonial institutions on the eve of the Revolution; the controversy with the Mother Country; war and diplomacy; transition from provincial to republican institutions. *Three times a week; first semester.* Professor GREENE

14. THE HISTORY OF AMERICAN POLITICAL IDEALS.—*Twice a week; both semesters.* Professor GREENE

15. THE CIVIL WAR AND THE RECONSTRUCTION.—The ante-bellum South and its destruction, 1844-1870. The civil war in the light of the forces which tended to hasten or obstruct the clash of arms. *Three times a week; second semester.*
Assistant Professor COLE

16. THE HISTORY OF THE EXPLORATION AND COLONIZATION OF THE WEST.—The Mississippi Valley from the beginning of the Spanish explorations to the close of the War of 1812. The development of the Mississippi Valley since 1815 and the progress of westward expansion to the Pacific. *Twice a week; both semesters.* Professor ALVORD

19. FRENCH CIVILIZATION FROM THE AGE OF LOUIS IX TO THE PRESENT.—*Twice a week; second semester.* Dr. JONES

20a. RECENT EUROPEAN HISTORY, 1848-1891.—The period of national consolidation and world-wide expansion. *Three times a week; first semester.*
Professor LYBYER

20b. RECENT EUROPEAN HISTORY, 1891 TO DATE.—The formation of alliances, the Balkan wars, and the Great War. *Three times a week; second semester.* Professor LYBYER

21. THE RECENT HISTORY OF THE UNITED STATES.—Introduction to contemporary American politics. *Twice a week; first semester.*
Associate Professor ROBERTSON

23. ENGLAND IN THE SEVENTEENTH CENTURY WITH SPECIAL REFERENCE TO THE PURITAN REVOLUTION.—The influence of Puritanism on the institutions and ideas of England and America. *Twice a week; second semester.* (Not given, 1918-19.) Dr. PEASE

24. EUROPEAN CONSOLIDATION AND COLONIAL EXPANSION, 1648-1789.—*Three times a week; first semester.* (Not given, 1918-19.) Professor LYBYER

25. THE FRENCH REVOLUTION, NAPOLEON, AND THE EUROPEAN REACTION, 1789-1848.—*Three times a week; second semester.* (Not given, 1918-19.)
Professor LYBYER

(Courses 24–25 and 20a–20b will ordinarily be given in alternate years.)

26. History of the Latin-American Colonies.—The political, economic, social, and intellectual life of Spain during the period of discovery. The exploration, settlement, and civilization of Spanish America and the Philippines. *Three times a week; first semester.* Associate Professor Robertson

27. History of Latin-America from the War of Independence to the Present Time.—The national history of the leading Latin-American states with Europe and the United States. The old regime in Texas, Mexico, and California. *Three times a week; second semester.* Associate Professor Robertson

29. The Far East.—The contact of Western nations with the Far East from the Portuguese establishments of the sixteenth century to the present time, with special reference to China and Japan. *Three times a week; second semester.* Professor Greene

30. The Ottoman Empire and the Question of the Near East.—The rise and greatness, and the beginning of the decline, of the Turkish power, 1300 to 1792. Turkey since 1792, with special attention to internal condition and international relations. *Twice a week; both semesters.* Professor Lybyer

31a–31b. The Mohammedan World.—Mohammed, the Saracen Empire, and the Moslem civilization, before the crusades. The history and culture, since the first crusade, of the Mohammedan peoples in Europe, Africa, and Asia, except the Ottoman Turks. *Twice a week; both semesters.* (Not given, 1918-19.) Professor Lybyer

40. The History of the British Commonwealth of Nations.—Conditions that led to English expansion; imperial institutions; development of the Colonial Nations. *Twice a week; first semester.* Professor Larson

52. East and West in Ancient Times.—History of Persia, Parthia, and the Sassanids, to the Moslem conquest; origins of the Eastern question; interrelation of East and West. *Three times a week; second semester.* (Not given, 1918-19.) Professor Olmstead

53. Assyrian History.—Sources, political thought, government of dependencies, parallels to more modern imperial states, and economic life of the Assyrian Empire. *Three times a week; first semester.* (Not given, 1918-19.) Professor Olmstead

HORTICULTURE

At least two years of collegiate work in horticulture and allied subjects and specific preparation for the chosen topics are required for entrance on major work in this department.

Courses for Graduates

103. Olericulture.—Special problems in vegetables. *Both semesters. One to two units.* Professor Lloyd

108. Pomology.—Special problems in small fruits and orchard fruits. *Both semesters. One to two units.* Professor Blair, Professor Crandall, Professor Lloyd, Assistant Professor Pickett

115. Floriculture.—The horticulture status of flowering plants, or special problems in the culture of greenhouse plants. *Both semesters. One to two units.* Professor Dorner

116. Chemistry of Plant Nutrition.—Special problems. *Both semesters. Three-fourths to one and one-fourth units.* (Not given, 1918-19.)

Courses for Graduates and Advanced Undergraduates

8. Orcharding.—Pomaceous, drupaceous, and nut fruits; orchard management. *Five times a week; first semester.* Assistant Professor Bailey

12. Evolution of Horticultural Plants.—History, botanical classification, and geographical distribution of cultivated plants; modification under culture; variation. *Three times a week; first semester.* Professor Crandall

17. Commercial Orcharding.—(Continuation of Horticulture 8.) Production and business methods in large orchards. A limited number of trips will be taken, cost not to exceed $10.00. For students specializing in pomology. *Five times a week; second semester.* Assistant Professor Bailey

18. Experimental Horticulture.—Methods and difficulties; planning of experiments; recording and interpretation of results. (For advanced students preparing for experiment-station work.) *Five times a week; second semester.* Professor Blair, Professor Pickett

22a–22b. Thesis and Investigation.—*Five to ten hours a week; both semesters.*

43. Greenhouse Fertilizers.—Soils and fertilizers; moisture and carbon-dioxide content of the air; temperature as related to greenhouse crops. *Three times a week; first semester.* Dr. Lehenbauer

44. Pomology Seminar.—Assigned topics; review of books, current technical journals, and other publications. For seniors and graduates specializing in pomology. *Once a week; both semesters.* Professor Pickett, Assistant Professor Bailey

45. Plant Nutrition.—Carbohydrates, proteins, organic acids, and other organic compounds of plants and their relation to plant nutrition. *Five times a week; both semesters.* Dr. Englis

46. Marketing Horticulture Products.—Fruits and vegetables. For seniors and graduates specializing in horticulture. *First semester; two credits.* Professor Lloyd

HOME ECONOMICS

This department offers graduate work along two lines, one dealing with the applications of the biological and physical sciences to the problems of food and nutrition; the other with the economic problems of the household. In either case the student must offer a minimum of ten hours' work with food, eight with textiles and clothing, five with the house, eight of chemistry, eight of biological science, and three in the principles of economics. In addition each student must offer five additional hours in economics or a second year of chemistry, including quantitative and organic chemistry, according to the line of specialization.

Courses for Graduates

101. Home Economics.—Industrial, educational, and sociological aspects. *Twice a week; first semester. One unit.* Professor Bevier

102. Special Investigations.—Application of the principles of bacteriology, chemistry, and physiology to the ordinary processes used in the preparation of food; nutrition. *Twice a week; both semesters. One unit.*
Professor Bevier, Miss Wardell

103. Seminar.—Recent advances in nutrition. *Once a week; second semester. One-half unit.* Miss Wardell

104. Economic Problems of the Family Group.—The economic phases of selected problems of the household. *Twice a week; both semesters. One unit.*
Dr. Perry

Courses for Graduates and Advanced Undergraduates

4. Food and Nutrition.—Application of the principles of science to the problems of food and nutrition. *Five times a week; first semester.*
Miss Wardell

15. Economics of the Family Group.—Brief history of the family with special reference to the development of the household; consumption of wealth; family income; family expenditures; interdependence of the family and the community. *Three times a week; first or second semester. One-half unit.*
Dr. Perry

20. Infant Nutrition.—*Twice a week; second semester.*
Miss Wardell

28. Organization of the Household.—Factors determining form and functions of the household; division of labor; use of machinery; domestic service; scientific management; cooperative housekeeping; retail markets. *Three times a week; second semester.* Dr. Perry

MATHEMATICS

Students entering on graduate study with a major in mathematics must have had twenty-five semester hours of undergraduate work in mathematics, including a year's course in calculus and a course in theory of equations, or in differential equations. They should be able to read German and French.

Candidates for a doctor's degree taking a first minor in mathematics are expected to have completed a course in calculus and are required to take two one-year courses beyond the calculus; candidates for a doctor's degree taking a second minor are required to complete at least one course throughout a year beyond the calculus.

Courses for Graduates

100. Seminar.—*Three times a week; both semesters. One to two units.* Professor Townsend, Professor Miller, Professor Shaw, Associate Professor Carmichael, Assistant Professor Emch, Assistant Professor Crathorne.

101. Functions of Real Variables.—*Three times a week; both semesters. One unit.* (Not given in 1918-19.) Professor Townsend

102. Functions of a Complex Variable.—*Three times a week; both semesters. One unit.* Professor Townsend

105. Calculus of Variations.—Simple and isoperimetric problems. *Three times a week; second semester. One unit.* Assistant Professor Crathorne

110a. Elliptic Functions.—The processes of analysis on which the theory of elliptic function depends; singly periodic functions; etc. *Three times a week; first semester. One unit.* Associate Professor Carmichael

110b. Elliptic Functions.—Approach to the theory of doubly periodic functions from the point of view of Weierstross's product expansion, of q-difference equations, and of functional equations; etc. *Three times a week; second semester. One unit.* Associate Professor Carmichael

111a. Automorphic Functions.—Geometry in the complex plane. The group-theoretic side of the theory. *Three times a week; first semester. One unit.* (Not given, 1918-19.) Assistant Professor Emch

111b. Automorphic Functions.—Function-theoretic developments and applications of automorphic function. *Three times a week; second semester. One unit.* (Not given in 1918-19.) Assistant Professor Emch

112a. Linear Difference Equations.—Elementary theory of differences; equations with constant coefficients; etc. *Three times a week; first semester. One unit.* (Not given, 1918-19.) Associate Professor Carmichael

112b. Linear Difference Equations.—General expansion problems. *Three times a week; second semester. One unit.* (Not given, 1918-19.) Associate Professor Carmichael

113. Linear Differential Equations in Real Variables.—General existence theorems; oscillation theorems and pendulum problems; etc. *Three times a week; first semester. One unit.* (Not given, 1918-19.) Associate Professor Carmichael

114. Linear Differential Equations in Complex Variables.—General existence theorems, function-theoretic considerations; etc. *Three times a week; second semester. One unit.* (Not given, 1918-19.) Associate Professor Carmichael

122. Modern Algebra.—*Three times a week; both semesters. One unit.* (Not given, 1918-19.) Assistant Professor Kempner

124. Theory of Numbers.—*Three times a week; both semesters. One unit.* Assistant Professor Wahlin

125. Continuous Groups.—Representation of certain continuous transformation groups by means of ordinary complex numbers. Lie's theory of differential equations, etc. *Three times a week; first semester. One unit.* Professor Miller

126. Finite Groups.—Substitution groups of low degrees. Sylow's theorem; etc. *Three times a semester; second semester. One unit.* Professor Miller

127. Theory of Groups.—Advanced course. *Three times a week; both semester. One unit.* (Not given, 1918-19.) Professor Miller

129. Theory of Statistics.—Methods of statistical investigation; application to problems in economics, sociology, and biology. *Three times a week; both semesters. One unit.* (Not given in 1918-19.) Assistant Professor Crathorne

130. Invariants and Higher Plane Curves.—Applications of the theory

of invariants to higher plans curves, etc. *Three times a week; both semesters. One unit.* Assistant Professor.....

131. Algebraic Surfaces.—The applications of homogenous coordinates and the theory of invariants to geometry of three dimensions; etc. *Three times a week. One unit.* (Not given in 1918-19.) Assistant Professor .....

132a. Projective Geometry.—*Three times a week; first semester. One unit.* Assistant Professor Emch

132a. Projective Geometry.—*Three times a week; first semester. One unit.* Assistant Professor Emch

135. Differential Geometry.—Applications of the calculus to the theory of curves and surfaces based primarily in the use of Cartesian coordinates; relation of the theory of surfaces to the theory of invariants of a pair of quadratic differential forms. *Three times a week; both semesters. One unit.* (Not given, 1918-19.)

141. Vector Methods.—The algebras of quaternions, space and analysis, and dyadics; differentials and integrals of space; applications to mechanics, elasticity, hydrodynamics, electrodynamics, and meteorology. *Three times a week; first semester. One unit.* (Not given, 1918-19.) Professor Shaw

142. General Vectors.—The algebras applicable to space of four dimensions, and N dimensions; differential and integral operators; applications to relativity problems of kinematics, mechanics, electrodynamics; general dyadics and applications. *Three times a week; second semester. One unit.* (Not given, 1918-19.) Professor Shaw

143. Linear Algebra.—A general study of the theory of linear associative and non-associative algebras, particular consideration of the types of algebras, and their chief representatives; applications. *Three times a week; first semester. One unit.* (Not given, 1918-19.) Professor Shaw

144. General Algebra.—The general theory of combinations of elements, with a study of the main types such as associativity, commutativity, and other limitation types; applications to the theory of infinite algebras and the theory of general operators. *Three times a week; second semester. One unit.* (Not given, 1918-19.) Professor Shaw

145. Fundamental Functions.—The theory of orthogonal and biorthogonal functions and expansions in terms of them, with particular study of several well-known cases; applications to the solution of differential and integral equations. *Three times a week; first semester. One unit.* Professor Shaw

146. Functional Transformations.—The theory of operators which transform functions into functions, particularly those related to the infinite algebras of orthogonal functions; applications to functions of lines, surfaces, etc., and to integro-differential equations; general infinite vector analysis. *Three times a week; second semester. One unit.* Professor Shaw

10. Theory of Equations and Determinates.—*Three times a week; first semester.* Professor Miller

16–17. Differential Equations and Advanced Calculus.—*Three times a week; both semesters.* Professor Townsend

19. Solid Analytical Geometry.—*Three times a week; second semester.*
Assistant Professor.....

21. Method of Least Squares.—*Twice a week; first semester.*
Professor Stebbins

30–31. Actual Theory.—Life contingencies; construction of life tables; valuation of policies; theory of risk; distribution of surplus; workmen's compensation; investment of funds; etc. *Three times a week; both semesters.*
Professor .....

32. History of Mathematics.—*Twice a week; second semester.*
Dr. Lytle

40. Fundamental Concepts of Mathematics.—Development of the number concept; concepts of unity; aggregate, order and correspondence; irrationals and limits, transcendence of *e* and *n;* etc. *Twice a week; second semester.* (Not given in 1918-19.) Dr. Lytle

MECHANICAL ENGINEERING

The prerequisite for graduate work in mechanical engineering is the equivalent of the undergraduate course required for the degree of Bachelor of Science in mechanical engineering in the branches of the subject in which registration is desired.

*Courses for Graduates**

106. Heat Motors.—The internal combustion motor; the steam turbine; refrigeration. *Twice a week; second semester. One unit.*
Professor Goodenough

107. Thermodynamics.—General theory; the solution of engineering problems. *Twice a week; either semester. One unit.* Professor Goodenough

109. Machine Design.—Rational design; mechanics of materials. Individual problems. *Twice a week; either semester. One unit.* Professor Leutwiler

112. Laboratory Investigations.—Combustion of fuels, boiler economy, steam engines and turbines, and similar subjects. *Three times a week; both semesters. One and one-half units.* Professor Richards and associates

114. Dynamics of Machinery.—Advanced problems; whirling and vibration of shafts; theory of governors; fly wheels; force and mass reduction; stresses in rotating masses. *Twice a week; both semesters. One unit.*
Professor Goodenough

MECHANICS, THEORETICAL AND APPLIED

The prerequisite for the course for graduates in theoretical and applied mechanics is the equivalent of the undergraduate courses in theoretical and applied mechanics and in allied engineering subjects required for the degree of Bachelor of Science in engineering.

*Courses offered to Junior and Senior students are open for minor credit to students majoring in other departments.

*Courses for Graduates**

101. Analytical Mechanics.—*Twice a week; first semester. One unit.* Professor Moore

102.—Resistance of Materials. — Analysis and investigation in mechanics of materials; the properties of materials used in engineering construction and the methods of determining these properties. *Twice a week; second semester. One unit.* Professor Moore

103. Hydraulics and Hydraulic Engineering.—The laws of hydraulics and their application to engineering problems; hydraulic power and its development; design and investigation. *Twice a week; second semester. One-half to one unit.* Professor Talbot

104. Experimental Work in Laboratory of Applied Mechanics.—(a) Laboratory investigation in the materials-testing laboratory; (b) experimental work in hydraulic laboratory; the laws of hydraulics; the development of power; hydraulic problems. *Twice a week; both semesters. One-half to two units.* Professor Talbott, Professor Moore

105. Experimental and Analytical Work in Reinforced Concrete.—Reinforced concrete and its action in structures. *Twice a week; both semesters. One to two units.* Professor Talbot

METEOROLOGY

(See Geology)

MINERALOGY

(See Geology)

MINING ENGINEERING

The prerequisite for graduate work in mining engineering is the equivalent of the undergraduate courses required for the degree of Bachelor of Science in mining in the branches of the subject in which registration is desired.

In addition to the regular University laboratories, the laboratory connected with the investigation of mining conditions in Illinois now being carried on jointly by the Engineering Experiment Station through the Department of Mining Engineering, the State Geological Survey, and the United States Bureau of Mines, is available for graduate instruction.

Courses for Graduates

Note:—Of courses 101, 103, 104, only one will be given, according to election of students. The same remark applies to 106 and 107.

100. Seminar.—*Once a week; both semesters. One unit.* Professor Stoek

101. Advanced Mining Methods.—Coal and ore fields of the United States; methods and economics of mining; utilization, marketing, storage, and transportation of coal and ores. *Twice a week; both semesters. One unit.* Professor Stoek

*Courses offered to Junior and Senior students are open for minor credit to students majoring in other departments.

103. History of Miners' Organizations.—*Twice a week; both semesters. One unit.* (Not given, 1918-19.) Professor Stoek

104. Mining Reports.—Law of the apex, the classification of coal and ore lands; conservation of mineral resources; mine examination and report. *Twice a week; both semesters. One unit.* Professor Stoek

105. Welfare Work and Education Among Mine Employees.—The organization and operation of mining institutes, night classes, welfare, mine rescue, and first-aid work. *Twice a week; both semesters. One unit.* (Not given in 1918-19.) Professor Stoek

106. History of Coal and Iron in the United States.—Discovery and development of deposits; interrelation of fuel and iron; charcoal period, anthracite period, coke period; the industries. *Twice a week; both semesters. One unit.* Professor C. M. Young

107. Subsidence of the Surface in Relation to Mining.—Theories of subsidence; action of different rock formations; effect on surface; other considerations. *Twice a week; both semesters. One unit.* Professor C. M. Young

MUNICIPAL AND SANITARY ENGINEERING

The prerequisite for graduate work in municipal and sanitary engineering is the equivalent of the undergraduate courses required for the degree of Bachelor of Science in municipal and sanitary engineering in the branches of the subject in which registration is desired.

Courses for Graduates

102. Water Supply Engineering.—Advanced work arranged to suit the requirements of individual classes. *One to three times a week; first or second semester. One unit.* Professor Talbot

103. Sewerage.—General sewerage design and construction; sewerage systems; hydraulics of sewers. *Once or twice a week; second semester. One unit.* Professor Talbot

106. Water Purification, Sewage Disposal, and General Sanitation.—Design, construction, and operation of water purification plants and of sewage disposal works; water filters, sewage tanks, etc.; garbage disposal and general sanitation. *Once a week; second semester. Half unit or more.* Professor Talbot

Courses for Graduates and Advanced Undergraduates

6a–6b. Water Purification, Sewage Disposal, and General Sanitation.—Impurities in water supplies and methods and processes of removal; sewage disposal; purification plants; garbage collection and disposal; sanitary restrictions and regulations and general sanitation. *Three times a week; first semester. Twice a week; second semester.* Professor Talbot, Associate Professor Eager

ORIENTAL LANGUAGES AND LITERATURES

Courses for Graduates and Advanced Undergraduates

1. Elementary Hebrew.—Grammar and reading. The Book of Genesis. *Three times a week; both semesters.* Professor Olmstead

2. Advanced Hebrew.—Readings in the sources for the early history. *Twice a week; both semesters.* Professor Olmstead

10. Elementary Assyrian.—Grammar, sign lists, and reading. *Three times a week; both semesters.* (Not given, 1918-19.) Professor Olmstead

PALEONTOLOGY

(See Geology)

PHILOLOGY

(See Comparative Philology, and Romance Philology under Romance Languages.)

PHILOSOPHY

Students entering on graduate work in philosophy must have had a general course in the history of philosophy, a course in logic, and a general course in psychology.

Courses for Graduates

103. Seminar in Ethics.—British ethics from Hobbes to Sidgwick. *Twice a week; both semesters. One unit.* Professor Daniels

107a–107b–107c. History of Philosophy.—(a) Plato and Aristotle. *Twice a week; both semesters. One unit.*

(b) Descartes, Spinoza, and Leibnitz. *Twice a week; both semesters. One unit.*

(c) Kant and Schopenhauer. *Twice a week;* (a) *both semesters. One unit.*

(The subjects in 1918-19 will be determined by the needs of the students registered.) Professor Daniels

108a–108b–108c. Seminar in Contemporary Philosophy.—(a) Idealism. *Twice a week; both semesters. One unit.*

(b) Realism and pragmatism. *Twice a week; both semesters. One unit.*

(c) The philosophy of Bergson. *Twice a week; both semesters. One unit.*

(The subjects in 1918-19 will be determined by the needs of the students registered.) Professor Bode

Courses for Graduates and Advanced Undergraduates

3. History of Ancient and Medieval Philosophy.—*Three times a week; first semester.* Professor Daniels

4. History of Modern Philosophy.—*Three times a week; second semester.* Professor Daniels

5. Political Philosophy.—A study of significant theories of the state, ancient, medieval and modern; state sovereignty and morality with special reference to international relations. *Twice a week; first semester.* Professor Daniels

7. Ethics.—The beginning and growth of morality; ethical theory; social and economic problems of the present. *Three times a week; second semester.* Professor Daniels

11. Philosophy of Religion.—Among the topics considered are: God; revelation; inspiration; dogma; prayer; faith; immortality; the problem of evil; the relation of morality and religion. *Twice a week; second semester.*

Professor Daniels

15. British Philosophers of the Eighteenth Century.—Locke, Berkeley, and Hume. *Three times a week; first semester.* Professor Bode

16. Philosophy of Pragmatism.—*Three times a week; second semester.*

Professor Bode

PHYSICS

The prerequisite for graduate work in physics is a college course in general physics with a year's laboratory course in introductory physical measurements. The student who is to do major work in physics should also have had additional courses in physics or teaching experience, unless the training in his minor subjects, mathematics or chemistry, has been strong and complete. He should also have a knowledge of French and German sufficient to use references in these languages. The courses named below are those open for candidates for the master's or doctor's degree. A large part of the last year's work of the candidate for the doctor's degree is investigational, along either the experimental or the theoretical side of physics. In addition to these major graduate courses, the courses in elementary dynamics, heat, light, electrical measurements, and introductory electrical theory are arranged with certain additions for graduate credit. The intermediate courses on electricity and magnetism, heat, and light (Physics 15, 16, 17), may be offered with certain additions by candidates for the master's degree and then generally only as minors.

Courses for Graduates

104a–104b. Selected Problems in Electrical Measurements.—(a) Measurement of high and low resistances by refined methods; aperiodic and ballistic galvanometers; damping factor and critical damping resistance of a galvanometer; electric current and quantity; absolute determination of capacity; the Dolezalek quadrant electrometer; properties of dielectrics; the measurement of v and e / m for cathode rays; positive electricity: the potentiometer. (b) Refined methods of measuring the magnetic properties of iron; plotting of hysteresis curves and the determination of hysteresis losses; the Siemens electrodynamometer; the measurement of self-and mutual-induction by various methods including Hughes induction balance; the Braun discharge tube in magnetic hysteresis; and the study of the characteristics of various forms of discharge tubes in the detection and amplification of electric waves. *Two times a week of three hours each; both semesters. Three-fourths unit.* (Course 104a is recommended for graduate students in chemistry.)

121. Recent Advances in Physics and the Electron Theory.—A series of demonstration lectures, in which members of the class will take turns in assisting. The universal occurrence of electrons; properties of the electron, and of the gaseous ion; determination of e / m and v of the electron, and of the ion; use of positive rays (kanal strahlen) in gas analysis; color effects of electrons,

of ions, and of retrograde rays in residual hydrogen, helium, neon and argon: determination of the elementary charge of the electron by means of the fog method, by radioactivity. *Second semester. One-fourth unit.* Professor KNIPP

123. SOUND.—Wave motion; forced vibrations; velocity and energy relations of sound waves; resonance; vibrations of strings and organ pipes. *Three times a week; second semester. Three-fourths unit.* Professor WATSON

124. CONDUCTION OF ELECTRICITY THROUGH GASES.—Experiments relating to discharge phenomena. In the second semester an original problem is assigned. *Two or three times a week; both semesters. One-half to two units.*

Professor KNIPP

126. PHYSICS COLLOQUIUM.—Weekly meetings of the instructors and advanced students of the department for the presentation and discussion of papers on current problems in physics. Attendance is expected of all the graduate students. *Once a week; both semesters. No credit.*

127. PROBLEMS OF PRESENT THEORETICAL INVESTIGATIONS IN PHYSICS.—The fundamental laws of nature, the principle of least action, equipartition of energy, entropy and probability, laws of radiation and the energy quantum. *Once in two weeks; both semesters. One-half unit.* Associate Professor KUNZ

131. INVESTIGATION OF SPECIAL PROBLEMS.—*Two to four times a week; both semesters. One to two units.* Professors CARMAN, KNIPP WATSON, Associate Professor KUNZ, Assistant Professors SCHULZ, WILLIAMS

132. MATHEMATICAL PHYSICS.—Special phases in theoretical physics.

132a. DYNAMICS.—Newton's equations; general method of integration; potential theory; general principles of dynamics according to d'Alembert, Gauss, Hamilton, Enter, Lagrange. The gyroscope and its applications. In the second part of the course applications of the dynamical principles will be made to physical and chemical phenomena in general. The principle of least action will be applied in electrodynamics, thermodynamics, elasticity, and in the theory of radiation. The present problems of theoretical physics will be studied, i. e., equipartition of energy, entropy and probability, the laws of radiation and the energy quantum. *Four times a week; both semesters. One unit.*

Associate Professor KUNZ

132. ELECTRODYNAMICS.—The potential theory applied to electrical and magnetic polarization; spherical harmonics, images and inversion, conjugate functions, elliptic coordinates and integrals, magnetic actions of currents, determination of coefficients of capacity, self and mutual induction, absolute measurements, Maxwell's theory with some applications in optics. *Four times a week; both semesters. One unit.* (Not given, 1918-19.) Associate Professor KUNZ

132c. THERMODYNAMICS AND KINETIC THEORY OF MATTER.—Chemical equilibrium; the Nernst theorem; Carnot's cycle; the thermodynamic potentials and the derived functions; Maxwell's theory of the distribution of velocities in a gas; Boltzman's H theory; the theory of radiation, especially Planck's theory of quanta. *Both semesters. One unit.* (Not given, 1918-19.)

Associate Professor KUNZ

132d. THEORY OF ELECTRICAL OSCILLATIONS; SPHERICAL AND CYLINDRICAL HARMONICS.—(Given in 1917-18; not given in 1918-19.)

Associate Professor KUNZ

132e. THEORY OF ELASTICITY.—(Given in 1917-18; not given in 1918-19.)
Associate Professor KUNZ

132f. DYNAMICS OF AVIATION.—Application of dynamics to aeronautics. General principles of flight, lift, and drag; theory of propellors; center of pressure of airplanes; stresses, principles of stability; resistance of parts of airplanes; wind tunnel experiments. *Three times a week; first semester. One unit.*
Associate Professor KUNZ

(For this course the students should have had a course in analytical mechanics corresponding to Physics 14a or to T. & A. M. 21.)

133. SEMINAR.—*Three or five times a week; both semesters. One to three units.* Professors CARMAN, KNIPP, WATSON, Associate Professor KUNZ, Assistant Professor SCHULZ.

Courses for Graduates and Advanced Undergraduates

4a–4b. ELECTRICAL AND MAGNETIC MEASUREMENTS.—(Special section for graduate students of chemistry during the first semester.) *Twice a week; both semesters.*
Professor KNIPP

14a. INTRODUCTION TO THEORETICAL PHYSICS.—Dynamics. Motion, mass, and force; problems from pure and applied physics. *Three times a week; first semester.*
Professor CARMAN

*15. ELECTRICITY AND MAGNETISM.—(Recommended to students in non-technical courses who wish a knowledge of electricity and magnetism beyond the course in general physics.) *Two recitations or lectures and one three-hour laboratory exercise weekly; first semester.*
Professor KNIPP

*16. HEAT.—Fundamental heat phenomena, the mechanical theory of heat, and elementary thermodynamics. Thermometry, calorimetry, vapor pressure, expansion of bodies, transmission of heat, mechanical equivalent. *Three times a week; first semester.*
Professor WATSON

*17. LIGHT.—Reflection, refraction, interference, diffraction, and polarization; telescopes, microscopes, refractometers, prism and grating spectroscopes, and interferometers. *Three times a week; second semester.*
Assistant Professor SCHULZ

20. LIGHT.—Special phenomena; modern theories; readings in Drude, Wood, and Preston. *Twice a week; first semester.* Assistant Professor SCHULZ

22. ADVANCED LIGHT MEASUREMENTS.—Wave length determinations with gratings, echelons, and interferometers; spectroscopic work; Zeeman effect; polarimetric analysis; determination of resolving power of instruments; photometry and spectrophotometry. *Twice a week; first semester.*
Assistant Professor SCHULZ

23. SOUND.—Origin, propagation, velocity, and interference of sound; vibration of strings, rods, and gas columns; physical theory of music and speech. *Three times a week; second semester.*
Professor WATSON

24. PROPERTIES OF MATTER.—Weight; mass; gravitation; elasticity; viscosity; surface tension; diffusion. Measurements including the use of the dividing engine, chronograph, etc. *Two times a week; second semester.*
Assistant Professor WILLIAMS

*These courses may be taken for a minor credit or as *first* year major credit only.

27. Fundamental Physical Measurements.—An advanced laboratory course in measurements of length, mass, time and of determinations of gravitation, elasticity, surface tension, viscosity, etc. *Once a week; second semester. One unit.*

30. Introduction to Theoretical Electricity.—Electrical and magnetic phenomena discussed with calculus methods. (For advanced students in physics, chemistry, mathematics, and engineering.) *Three times a week; second semester.*
Professor Knipp

PHYSIOGRAPHY

(See Geology)

PHYSIOLOGY

The prerequisites for graduate work in physiology are physiology 4 or 3 and 6.

Courses for Graduates

100. Physiology of Secretion and Excretion.—The secretions of mammals; the factors controlling the flow of these juices. *Three times a week; first semester. Three-fourths unit.* Assistant Professor Burge

101. Journal Club.—Review of literature and discussion of investigation carried on in the department. *Once a week; both semesters. One-fourth unit.*
Members of the staff

102. Research.—*Three times a week; both semesters. One or two units.*
Members of the staff

Courses for Graduates and Advanced Undergraduates

1. Histology.—The fundamental mammalian tissues. *Three times a week; first semester.* Mr. Ashman

2. Experimental Physiology.—Nerve; muscle; circulation; secretion; digestion; metabolism. *Five times a week; second semester.*
Assistant Professor Burge, Miss Neill

3. Experimental Physiology.—Nerve and muscle. *Twice a week; first semester.* Miss Neill

5. Physiology of Nutrition.—Utilization of food material by the body in health under various conditions and in disease. *Twice a week; second semester.*
Assistant Professor Burge

6. Physiology of the Nervous System.—Function of the principal motor and sensory tracts and of the autonomic nervous system of the mammal. *Three times a week; first semester.* Assistant Professor Burge and Miss Neill

7. Investigation.—*Twice a week; both semesters.* Members of the staff

8. Histology.—Microscopic anatomy of the organs. *Three times a week; second semester.* Mr. Ashman

9. Physiology of the Special Senses.—*Twice a week; second semester.* Assistant Professor Burge, Miss Neill and Mr. Ashman.

POLITICAL SCIENCE

Graduate work in political science is conducted in the following special

fields: (1) Political theory; (2) international law and diplomacy; (3) comparative government; (4) constitutional law, administrative law, and jurisprudence; (5) municipal administration.

To be admitted to take political science as a major subject, the student must have done at least 18 hours of undergraduate work in political science, economics, and history, not less than nine hours of which must have been in political science. To take political science as a minor he must have had at least nine hours' work in these fields, including six hours in political science.

If a student making political science his major is taking both of his minors in other departments, one of them must be in history, economics, or sociology.

Several courses given in other departments are so closely related to those in political science that graduate students whose major is political science may be permitted on petition to take such courses as part of their major work. Attention is also called to the technical courses given by the department of municipal and sanitary engineering.

Courses for Graduates

101. History of Political Theories.—Political theories of Aristotle, Machiavelli, Hobbes, Locke, Montesquieu, Rousseau, and others; evolution of American political ideas. *Twice a week; first semester. One unit.* (Not given, 1918-19.) Professor Garner

102. The Nature of the State.—*Twice a week; first semester. One unit.* Professor Garner

103. Seminar in Political Science and Public Law.—*Once a week; both semesters.* Members of the department

104. Municipal Government.—Special attention devoted to the problems of government in metropolitan districts, *e. g.*, the multiplicity of governmental units; overlapping functional activities; state and multistate control within metropolitan areas; proposed remedies such as home rule, consolidation of local governments, and city states. *Twice a week. One unit. Time to be arranged.*

106. International Law as Applied During the European War.—Questions of war law arising during the present European war, such as the rights and duties of neutrals, contraband, right of search, capture, continuous voyage, transfers of flag, blockade. *Twice a week; second semester. One unit.* Professor Garner

107. Foreign Relations of the United States.—Studies in the principles and practises of American foreign policy. *Once a week; second semester. One unit.* Associate Professor Mathews

112. Public Administration.—Comparative studies in national and local administration. *Twice a week; first semester. One unit.* Professor Fairlie

113. State Government and Administration.—Studies in the organization and methods of state governments in formulating and executing public policies. *Once a week; second semester. One unit.* (Not given, 1918-19.) Associate Professor Mathews

Courses for Graduates and Advanced Undergraduates

4. Municipal Government.—*Three times a week; first semester.* Dr. Cushman

5. Constitutional Law of the United States.—*Three times a week; first semester.* Dr. Cushman

6. International Law.—*Three times a week; first semester.* Professor Garner

7. American Diplomacy.—*Three times a week; second semester.* Associate Professor Mathews

9. Principles of Jurisprudence.—The nature and sources of law; historical development and comparison of Roman law and the English legal system; English common law in the United States; relation between statutes and judicial decisions; classification of law. *Twice a week; second semester.* Professor Fairlie

10. Administrative Law in the United States.—Administrative organization; separation of powers and delegation of legislative powers; nature and scope of administrative power; administrative procedure and methods of enforcing governmental commands; remedies of the individual against unlawful official action. *Three times a week; second semester.* Dr. Cushman

11. Constitutional Aspects of Social and Industrial Problems.—The police power; constitutional limitations on legislation concerning the public health and safety; the control of public service corporations and combinations of capital and labor. *Three times a week; first semester.* Dr. Cushman

12. National Administration in the United States.—The President and his Cabinet; the executive departments and the administrative services of the national government. *Three times a week; second semester.* Professor Fairlie

13. State Administration in the United States.—*Three times a week; first semester.* Associate Professor Mathews

14. Political Parties.—Development of political parties and their organization and influence on the government mainly, in the United States and Great Britain; recent legislation on primaries and nomination methods in this country. *Twice a week; first semester.* Professor Fairlie

18. Legislation in the United States.—Nature of legislative power; representation; legislative organization, procedure and practises; bill drafting; legislative reference bureaus; popular law making; tendencies in legislation. *Three times a week; second semester.*

21. British Government.—Political institutions in the United Kingdom and British Possessions. *Three times a week; first semester.* Professor Fairlie

22. Continental European Government.—The national political systems of France, Germany, Italy, Austria-Hungary, and Switzerland. *Three times a week; second semester.* Professor Garner

28. Problems of Contemporary Politics.—Reorganization of state government; state socialism; immigration; foreign and colonial policies; parliamentary government: direct popular government. *Twice a week; first semester.*

34. Municipal Problems.—Municipal administration in the United States and Europe; municipal organization and relations to the state; municipal owner-

ship and regulation of public utilities; city planning and housing; police and sanitary administration; municipal finances. *Three times a week; second semester.* Professor FAIRLIE

35. LEGAL PROBLEMS OF THE CITY.—Legal status of the city; powers in police regulations, taxation, special assessments, streets, public utilities, and city planning; municipal contracts and liabilities. *Twice a week; second semester.* (Not given, 1918-19.) Dr. CUSHMAN

PSYCHOLOGY

Graduate students who elect psychology as their major subject must have had standard courses, of university grade, both in general psychology and in the psychological laboratory. One general university course is the minimal requirement for graduate students who apply to the department for a minor subject.

Courses for Graduates

103. RESEARCH.—Experimental and historical investigations. *Both semesters. One-half to two units.*
Professor BENTLEY, Assistant Professor RUCKMICH, Dr. RAHN

105. SEMINAR.—Current topics in their historical setting. *Once a week, two hours; both semesters. One-half unit.* Professor BENTLEY

Courses for Graduates and Advanced Undergraduates

5–6. COMPARATIVE PSYCHOLOGY.—Mind in the animal forms. *Twice a week; both semesters.* Professor BENTLEY, Dr. RAHN

9. PHYSIOLOGICAL PSYCHOLOGY.—The psychophysical relationships. *Three times a week; second semester.* Dr. RAHN

10. GERMAN READING.—Translation of technical German treatise on psychological subjects. *Once a week; first semester.* Professor BENTLEY

12–13. MINOR PROBLEMS.—Methods suitable to new problems. *Two to five times a week; both semesters.*
Professor BENTLEY, Assistant Professor RUCKMICH, Dr. RAHN

14. SOCIAL PSYCHOLOGY.—The social consciousness, its factors and conditions; the psychology of peoples. *Three times a week; first semester.*
Dr. RAHN

16. GENETIC PSYCHOLOGY.—Instinctive responses; habits; development of mental functions in the child from birth to maturity. *Twice a week; first semester.* Assistant Professor RUCKMICH

17. THE HISTORY OF PSYCHOLOGY.—*Twice a week; second semester.*
Assistant Professor RUCKMICH

18. PSYCHOLOGICAL PROBLEMS OF THE WAR.—Theoretical discussion of instinctive basis, of general and pathological effects on individuals and on social groups, and of the results of special investigations made with reference to military problems and conditions, such as the mental examination of recruits, the rehabilitation of returned soldiers, orientation, and the localization of sound. *Twice a week; first semester.* Assistant Professor RUCKMICH

20. SYSTEMATIC PSYCHOLOGY.—*Three times a week; second semester.*
Professor BENTLEY

21–22. Special Studies.—Individual investigation for advanced students. *Three times a week; both semesters.*
Professor Bentley, Assistant Professor Ruckmich, Dr. Rahn

RHETORIC
(See English)

ROMANCE LANGUAGES AND LITERATURES

Before entering upon the study of Romance Languages as a major for the degree of A.M., the candidate must have had at least (a) three years of college work in one Romance language, together with a satisfactory knowledge of another; or (b) two years of college work in each of two Romance languages. Before being accepted as a recognized candidate for the degre of Ph.D., he must have had in addition satisfactory training in Latin. Before entering on the study of Romance languages as a first or second minor, the candidate must have had two years of college work in the language desired.

French

Courses for Graduates

101. Old French Epic Literature.—Reading and interpretation of the greater national and courtly epics; the history of these types of medieval literature. *Twice a week; both semesters. One unit.* Professor Oliver

102. Old French Lyric and Prose Literature.—Interpretation of the earlier Old French didactic, chronicle, and lyric writers. *Twice a week; both semester. One unit.* (Not given, 1918-19.) Professor Oliver

106. Early French Drama.—Origins of the drama in France, and its development up to the Renaissance. *Twice a week; both semesters. One unit.* (Not given, 1918-19.) Associate Professor Carnahan

103. Seventeenth Century Prose Writers.—French culture, society, and prose literature of the seventeenth century; great preachers and moralists; Jansenism and Port Royal; formation of the classic ideals. *Once a week; both semesters. One-half unit.* (Not given, 1918-19.) Professor Oliver

104. Eighteenth Century Prose Writers.—Society, culture, and prose literature of the eighteenth century. The attack on the classic ideals; growth of the revolutionary spirit. *Once a week; both semesters. One-half unit.*
Professor Oliver

119. Belgian Literature in French since 1880.—*Twice a week; second semester. One unit.* Dr. Gillet

127. French Romanticism.—*Twice a week; both semesters. One unit.*
Associate Professor Carnahan

Courses for Graduates and Advanced Undergraduates

10a–10b. General Survey of French Literature.—*Three times a week; both semesters.* Associate Professor Carnahan

24a–24b. French Drama of the Seventeenth and Eighteenth Centuries.—Corneille, Racine, Moliere, Voltaire, Marivaux, Sedaine, Beaumarchais.

Three times a week; both semesters. Professor OLIVER

17a–17b. FRENCH DRAMA OF THE NINETEENTH CENTURY.—Hugo, Dumas, Augier, Sardou, Becque, Brieux, Lavedan, Hervieu, Rostand. Dramatic criticism. *Twice a week; both semesters.* Professor MCKENZIE

45a–45b. FRENCH REALISM.—Balzac, Flaubert, E. and J. de Goncourt, Daudet, Zola, Maupassant. Lectures; collateral reading. *Twice a week; both semesters.* Dr. MOORE

47. FRENCH LITERARY CRITICISM IN THE NINETEENTH CENTURY.—Sainte-Beuve, Taine, Brunetiere and other critics. Lectures and reports. *Three times a week; second semester.* Dr. GILLET

55. CONTEMPORARY FRENCH LITERATURE.—Writers of the present generation. *Three times a week; first semester.* Dr. GILLET

ITALIAN

Courses for Graduates

140. ITALIAN LITERATURE OF THE THIRTEENTH AND FOURTEENTH CENTURIES.—Dante, Petrarch, Boccacio. *Twice a week; first semester. One unit.* Professor MCKENZIE

143. ITALIAN LITERATURE OF THE FIFTEENTH AND SIXTEENTH CENTURIES.—*Twice a week; first semester. One unit.* (Not given, 1918-19.) Professor MCKENZIE

146. MODERN ITALIAN LITERATURE.—Italian writers of the nineteenth century. *Twice a week; second semester. One unit.* Professor MCKENZIE

Course for Graduates and Advanced Undergraduates

2a–2b. ITALIAN LITERATURE.—Reading; composition; conversation. Introduction to Dante. *Twice a week; both semesters.* Dr. VAN HORNE

SPANISH

Courses for Graduates

132. THE NOVELA OF THE GOLDEN AGE.—Political and social conditions in Spain from 1560 to 1700; the kinds of prose fiction produced in this period; *Don Quixote* and the *Novelas Exemplares* of Cervantes. *Twice a week; both semesters. One unit.* (Not given, 1918-19.) Professor FITZ-GERALD

133. ORIGIN OF THE SPANISH NOVELA AND OF THE COMEDIA.—The development of Spanish prose fiction and of Spanish dramatic art for the period previous to the Golden Age. *Twice a week; both semesters. One unit.* Professor FITZ-GERALD

134. THE SPANISH BALLAD.—Types of the ballad. *Twice a week; both semesters. One unit.* (Not given, 1918-19.) Dr. SEYMOUR

135. THE MODERN NOVEL IN SPAIN.—Development of the modern novel in Spain from the middle of the nineteenth century to the present time. Development of the novel in Spain, France, and Italy. *Twice a week; both semesters. One unit.* (Not given, 1918-19.) Dr. SEYMOUR

137. Spanish Satire.—Development of satire in Spanish literature from the earliest monuments to the present. *Twice a week; both semesters.*
Dr. Seymour

139. Spanish Literature in the Middle Ages.—Lectures on the history of Spanish literature from its origins through the reign of John II of Castile. Assigned reading and reports. *Twice a week; both semesters. One unit.* Hours to be arranged. Professor Fitz-Gerald

Courses for Graduates and Advanced Undergraduates

10a–10b. General Survey of Spanish Literature.—*Twice a week; both semesters.* (Not given, 1918-19.) Dr. Seris

11a–11b. Spanish Drama of the Sixteenth and Seventeenth Centuries. —Dramatists of the classical period; Lope de Vega, Calderon, Tirso de Molina, and Ruiz de Alarcon. *Twice a week; both semesters.* Dr. Seymour

17a–17b. Spanish Drama of the Ninteenth Century.—*Twice a week; both semesters.* Dr. Van Horne

Romance Philology

Courses for Graduates

171. Introduction to Romance Philology.—Historical phonology and morphology of the Romance languages. *Twice a week; both semesters. One unit.* (Not given, 1918-19.) Professor Fitz-Gerald

175. Old French Phonology and Morphology.—Development of Old French from Vulgar Latin. *Once a week; both semesters. One-half unit.*
Professor Fitz-Gerald

179. Old Provencal.—Historical grammar; selected texts. *Once a week; both semesters. One-half unit.* Dr. Moore

181. Origin and Formation of the Italian Language.—Thirteenth century texts. *Twice a week; second semester. One unit.* (Not given, 1918-19.)
Professor McKenzie

185. Oldest Monuments of the Spanish Language; Origins of Spanish Poetry.—Historical grammar and paleography; interpretation of texts. *Twice a week; both semesters. One unit.* Professor Fitz-Gerald

191. Fables and Bestiaries.—History of animal literature, especially the medieval French and Italian collection. *Twice a week; second semester. One unit.* (Not given, 1918-19.) Professor McKenzie

195. Seminar.—Research work in preparation for theses in the field of the Romance languages. *Both semesters. One unit.* Members of the department

SCANDINAVIAN LANGUAGES

(See English)

SOCIOLOGY

Preparation for graduate work in sociology must include at least the equivalent of twelve semester hours in the social sciences, of which at least three must be in sociology, and three in the principles of economics. The remainder may be in any combination of these two subjects, or of history and political science.

Courses for Graduates

100. Bases of Social Theory.—*Twice a week; first semester. One unit.*
Professor Hayes

101. Sociological Method.—Adaptability to sociological investigation of methods described in Pearson's *Grammar of Science,* Wundt's *Methodenlehre, zweite abtheilung.* Seignobos' *La Methode Historique Appliquee aux Sciences Sociales,* Bernheim's *Historische Methode,* Spencer's *Study of Sociology,* and Giddings's *Inductive Sociology. Three times a week; first semester. One unit.*
Professor Hayes

102. The Development of Sociology.—*One session, two hours, each week; both semesters. One unit.* Professor Hayes

150. Seminar.—Preparation of theses; detection and statement of problems. *One session of two hours each week; both semesters. One to two units.*
Professor Hayes

(Note: One of the three courses last described will be omitted in 1918-19; which one is omitted will depend on the election of students.)

Courses for Graduates and Advanced Undergraduates

2. Social Psychology and Social Control.—Current tendencies in the psychological interpretation of social life; ways in which the sentiments, opinions, and conduct of the members of society are shaped. *Three times a week; second semester.*

3. Social Evolution.—The explanation of progressive social change, derived by applying the comparative method to ethnographic and historical materials relating to family organization, practical arts, economic wants and institutions, government and law, moral codes, and religions as they have appeared among savage, barbarous, and civilized peoples. *Three times a week; second semester.* Professor Hayes

8. Charities.—The evolution of modern organized philanthropy, public and private; causes and prevention of poverty; organization and management of charitable institutions. *Three times a week; first semester.* Dr. Stevens

9. Criminology.—Nature, causes, and treatment of the criminal; evolution of modern methods of criminal procedure and penology; recent experiments and tendencies. *Three times a week; second semester.* Dr. Stevens

10. Problems of Population.—*Three times a week; first semester.*
Dr. Stevens

12. See Labor Problems (Economics 12).—*Three times a week; both semesters.* Dr. Watkins

14. Social Statistics.—Social investigation and research. Social and community surveys. The verification of sociological laws and principles by means of statistical method. *Three times a week; second semester.* Dr. Stevens

15. The Family.—Evolution of the family and marriage; educational, moral, and political significance of the family at different stages of social development. *Twice a week; both semesters.* (Not given, 1918-19.)

21. See Socialism and Economic Reform (Economics 21).—*Two times a week; second semester.* Professor Kinley

SPANISH

(See Romance Languages)

ZOOLOGY

At least sixteen semester hours of college work in zoology are required for entering on major graduate study in this subject. Under special circumstances advanced work in closely allied subjects may be accepted in lieu of the fourth semester's work in zoology. When zoology is chosen for a minor the courses listed for graduates and undergraduates must be preceded by at least one full year's undergraduate work in zoology.

For the prosecution of graduate study in zoology a reading knowledge of German and French is indispensable and familiarity with Latin and Greek is of great advantage.

Every candidate for the doctor's degree is expected to spend at least one summer in study at the seashore. To facilitate this plan an investigator's room has been provided at the Woods Hole Marine Biological Laboratory, where members of the department are afforded research facilities without cost to themselves. Application for the use of this room should be made to the head of the department early in the year. Similar facilities are afforded at the Harpswell Marine Laboratory.

Courses for Graduates

102. Selected Topics from Vertebrate Morphology.—Origin of vertebrates; segmentation of the head; morphology of special systems. *Twice a week; first semester. One-half unit.* Professor Kingsley

106. Ontogeny of Vertebrates.—Detailed study of germ layers and ontogeny, with plastic and graphic reconstructions. Based chiefly on Elasmobranchs and Amphibians. *First semester. One unit.* Professor Kingsley

107. Parasitology.—Structure and life history of animal parasites; their relations to disease; origin and biological significance of parasitism. *Twice a week; both semesters. One unit.* (Given in 1918-19 and in alternate years.) Professor Ward

109–109a. Physiological Ecology.—The regulatory mechanism of organisms; neutrality, osmotic pressure, immunity, and temperature in relation to natural environments. 109 *twice a week;* 109a assigned readings and reports. *One-half unit each.* (Given in 1918-19 and in alternate years.) Assistant Professor Shelford

110–110a. Economic Ecology.—Application of principles of physiology and ecology to problems of fisheries and pollution; insect pests and weather; forestry and conservation; 110 *twice a week;* 110a assigned reading and reports. *Second semester. One-half unit each.* (Given in 1917-18 and in alternate years.) Assistant Professor Shelford

111. Experimental Ecology.—Repetition of published experiments in physiology and ecology, and study of modern methods and apparatus. *Both semesters. One-half to two units.* Assistant Professor Shelford

115. Factors of Individual and Racial Development.—Experimental em-

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UNIVERSITY OF ILLINOIS BULLETIN

ISSUED WEEKLY

Vol. XVII SEPTEMBER 15, 1919 No. 3

[Entered as second-class matter December 11, 1912, at the post office at Urbana, Illinois, under the Act of August 24, 1912. Acceptance for mailing at the special rate of postage provided for in section 1103, Act of October 3, 1917, authorized July 31, 1918.]

THE GRADUATE SCHOOL

OF THE

UNIVERSITY OF ILLINOIS

1919-1920

PUBLISHED BY THE UNIVERSITY OF ILLINOIS
URBANA

THE UNIVERSITY OF ILLINOIS

THE STATE UNIVERSITY

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THE GRADUATE SCHOOL

OF THE

UNIVERSITY OF ILLINOIS

Announcement for
1919-1920

PUBLISHED BY THE UNIVERSITY OF ILLINOIS
URBANA

ILLINOIS PRINTING COMPANY
DANVILLE, ILL.

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THE UNIVERSITY CALENDAR
1919-1920

As Applicable to the Graduate School

FIRST SEMESTER, 1919-1920

1919

Sept. 22, 23, Monday, Tuesday	Registration days
Sept. 24, Wednesday, 8 a. m.	Instruction begun
Nov. 3, Monday, 5 p. m.	Latest day for announcement of subjects for graduate theses
Nov. 27, Thursday	Thanksgiving Day
Dec. 3, Wednesday	Illinois Day
Dec. 20, Saturday, 11 a. m.	Holiday recess begun
Dec. 31, Wednesday, 5 p. m.	Latest day for submission of outlines of theses by candidates for professional degrees in engineering

1920

Jan. 5, Monday, 1 p. m.	Instruction resumed
Jan. 29, Thursday	Semester examinations begun
Feb. 5, Thursday	Semester examinations ended

SECOND SEMESTER, 1919-1920

Feb. 9, 10, Monday, Tuesday	Registration days
Feb. 11, Wednesday, 8 a. m.	Instruction begun
Feb. 12, Thursday	Lincoln Day
April 1, Thursday, 5 p. m.	Latest day for filing of completed theses by candidates for professional degrees in engineering
April 1, Thursday, 11 a. m.	Easter recess begun
April 6, Tuesday, 1 p. m.	Instruction resumed
May 15, Saturday, 12 m.	Latest day for receipt by the Dean of the Graduate School of certified copies of doctors' theses
June 3, Thursday, 8 a. m.	Final examinations begun
June 5, Saturday, 12 m.	Latest day for receipt by the Dean of the Graduate School of certified copies of masters' theses
June 10, Thursday	Final examinations ended
June 13, Sunday	Baccalaureate address
June 15, Tuesday	Alumni Day
June 16, Wednesday	Forty-ninth Annual Commencement

THE EXECUTIVE FACULTY

Edmund Janes James, Ph.D., LL.D., President of the University (*on leave*)
David Kinley, Ph.D., LL.D., *Professor of Economics and Acting President*

Arthur Hill Daniels, Ph.D., *Professor of Philosophy and Assistant Dean of Graduate School*
Albert Pruden Carman, A.M., D.Sc., *Professor of Physics*
Robert Daniel Carmichael, Ph.D., *Associate Professor of Mathematics*
Julius Goebel, Ph.D., *Professor of Germanic Languages*
Harry Alexis Harding, Ph.D., *Professor of Dairy Bacteriology*
Laurence Marcellus Larson, Ph.D., *Professor of History*
Herbert Windsor Mumford, B.S., *Professor of Animal Husbandry*
William Albert Noyes, Ph.D., LL.D., *Professor of Chemistry*
William Abbott Oldfather, Ph.D., *Professor of Classics*
Ellery Burton Paine, M.S., E.E., *Professor of Electrical Engineering*
Stuart Pratt Sherman, Ph.D., *Professor of English*
Arthur Newell Talbot, C.E., *Professor of Municipal and Sanitary Engineering*
Henry Baldwin Ward, Ph.D., *Professor of Zoology*
Charles Maxwell McConn, A.M., *Registrar, Secretary of the Faculty*

HISTORY AND ORGANIZATION

The University of Illinois offered facilities for advanced study and research in various lines as early as 1872. Organized graduate instruction, however, under the name of the Graduate School, was first undertaken in 1892. In 1894 the administration of the school was vested in the Council of Administration, and the Vice-President of the University became Dean of the School. In 1906 the Graduate School was organized as a separate faculty, consisting of a dean and members of the University faculty assigned to this duty by the President.

By action of the Trustees the teaching faculty of the Graduate School includes all members of the University faculty who give instruction in approved graduate courses. The affairs of the School, however, are in charge of the Executive Faculty appointed each year by the President.

ADMISSION

Admission to the Graduate School may be granted to graduates of institutions whose requirements for the bachelor's degree are substantially equivalent to those of the University of Illinois, and to applicants from other institutions approved by the Executive Faculty, as hereinafter provided. *Admission to the Graduate School does not, however, imply admission to candidacy for an advanced degree, and gives no right or claim to be so admitted. Such candidacy is determined by the Faculty after the student has demonstrated by his work here, for from two to five months, that he has the ability to do major work of graduate character. A mere accumulation of "credits" or "grades" is not sufficient.*

A graduate of an institution meeting the requirements of a standard college as described below, may be admitted to the Graduate School, provided he satisfies the Dean and the departments concerned that he will be able to proceed to the master's degree in a period not exceeding two years.

For purposes of admission to the Graduate School a *standard college* is one which meets the following requirements:

1. An enrollment of not fewer than one hundred students of college grade, with an average for a series of years of at least twenty-five per cent registered in the junior and senior classes.

2. A graduation requirement of four years (120 semester hours) of collegiate grade.

3. A minimum entrance requirement of 14 units. By the minimum requirement is meant the smallest number of units with which a student may be permitted to begin college work, i. e., the nominal requirement minus the number of units of conditions allowed.

4. A requirement that all entrance conditions must be removed before a student may be permitted to begin a second year of work in the same institution.

5. Not less than eight distinct departments in liberal arts and sciences, with at least one professor giving full time to college work in each department.

6. A minimum educational attainment of all college teachers of academic subjects equivalent to graduation from a college of high grade and graduate work equal to that required for the master's degree at the University of Illinois.

7. A maximum of 16 semester hours per week required of college teachers.

8. A maximum enrollment of 30 students in recitation or laboratory sections.

9. Buildings and equipment of the value of at least $100,000.

10. A productive endowment sufficient to yield a net annual income of at least $10,000 available for instructional purposes in the college department (liberal arts and sciences). If the institution offers courses in addition to the usual liberal arts course, it shall have a correspondingly larger income.

11. A library of not less than 10,000 bound volumes in addition to public documents.

12. Laboratory equipment of a value of not less than $3,000 in physics ($4,000 if work is offered in advance of one year-course), $2,500 in chemisrty, and $2,500 in biology.

13. In addition to the foregoing specific requirements, the general standard of the administration and faculty shall be considered.

Admission to graduate courses may be granted only to those who have had the requisite undergraduate work in those courses or departments. But a student of mature age who satisfies the Dean and the department concerned of his ability to pursue graduate work in a given line may be enrolled in particular graduate courses, without reference to a degree, and permitted to carry on such study or investigation under the direction of a department of the University as the department shall recommend and the Dean approve.

Application blanks for admission may be secured from the Registrar of the University. Every applicant must submit with his application for admission an official transcript of his college record.

CHARACTER OF GRADUATE WORK

The principal aim of graduate study is the development of the power of independent work and the promotion of the spirit of research. Each candidate for a degree is expected to have a wide knowledge of his subject and of related fields of work; for the graduate student is not expected to get from lecture and laboratory courses all the knowledge and training necessary to meet the requirements for his degree.

Students, especially candidates for the doctor's degree, are warned against restricting themselves to the courses prescribed or suggested by the departments in which they are studying. Each student is expected to do a wide range of private reading and study, and in many cases will find it advisable

to take one or more courses of lectures quite outside the field of his chosen subject.

REGISTRATION AND PROGRAM OF STUDY

The following regulations concerning registration and program of studies are laid out primarily for first-year students. Second-year and third-year graduate students fill out their programs irrespective of the unit value of courses, according to their needs, under the advice of their instructors.

Registration.—Each graduate student must register when he first connects himself with the University and afterwards at the beginning of each semester.

The registration of a new student may be accepted at any time provided the student is prepared to take up courses actually under way. Credit towards the fulfillment of the residence requirement dates, however, from the time of registration and not from the beginning of the semester or year in which the student enters. Registration will not be permitted later in the year than April 1, except in the case of students who expect to continue through the summer session, or are returning to complete a year's work which has been broken into by illness or other unavoidable interruption.

The first registration, or that upon entrance, is permitted only after the student's application for admission to the Graduate School, setting forth his educational attainments, has been duly approved.

A new student must fill out in duplicate an application for admission and submit it to the Registrar, from whom, after the approval of his application, he will receive a card of admission and a study-list which will give details of procedure in registering. He should fill out the study-list after consultation with his adviser, or the person in charge of his major work, and also with the instructors whose courses he wishes to elect. *In all cases, registration must be completed within two weeks.* Otherwise it is subject to a fee of one dollar.

Changes in Study-Lists.—A graduate student is expected to plan his work so carefully that changes in his study-list during the semester will not be necessary. When a change seems advisable, however, it may be permitted without fee if made within three weeks of the date of registration. After that date a fee of one dollar is charged for each change, except that the total charge for a rearrangement authorized on any one change slip shall not exceed two dollars.

Advisers.—The person in charge of the major work of the student becomes his adivser, and, together with those with whom the student is taking first and second minor courses, forms a committee with general supervision over the student's general course of study. This committee is expected to follow the student's work, to assist him in planning his course and to give him such advice as may be necessary concerning his scholastic career.

Undergraduate Courses Open to Graduate Students.—Courses to which sophomores are regularly admitted may not be taken for graduate credit, either major or minor.

Unless otherwise specified on the student's program by the department concerned, a course for graduates and advanced undergraduates, not open to students below senior grade and counting four or five hours of undergraduate credit, if taken by graduate students, will be treated as a unit course; when counting less than four hours of undergraduate credit, such a course, if taken by graduate students, will be treated as a half-unit course.

Unless otherwise specified on the student's program by the department concerned, a course the prerequisites of which are such as make it possible for juniors to be admitted, if taken by a graduate student, is counted as a half-unit course where the undergraduate credit is four or five hours, or a quarter-unit course where the undergraduate credit is two to three hours.

Transfer of Undergraduate Credit.—No credit earned during the undergraduate course may be transferred for graduate credit, unless such credit was earned in time additional to the time normally required for the bachelor's degree, in the second semester of senior year, and then only for minor subjects, and on petition. When undergraduate courses with variable semester hours are counted for graduate credit, the transfer is made on the basis of one unit for four semester hours.

If at the end of the first semester of his senior year a student has so far completed his work for the bachelor's degree that his program for the second semester is not full, he may elect one or more graduate courses. But such election must be in accordance with Graduate School rules and must be approved by the Dean. In no case may courses be counted for graduate credit on a program which requires more than twelve formal class, lecture or laboratory exercises a week, without petition.

Failures.—A graduate student who fails in any course in his major subject cannot secure his degree in the same year in which the failure occurred. No condition examinations are given graduate students.

Miscellaneous and Listeners' Courses.—Graduate students are permitted under proper circumstances to attend classes as listeners, and to elect miscellaneous subjects, that is, courses which do not count towards an advanced degree. Listeners' cards may be obtained at the Dean's office. Under the authority conferred by the faculty on the Dean no student with a full minimum program will be permitted by the Dean to visit more than one class or to take more than one miscellaneous subject, nor is any subject open as a listener's or miscellaneous course unless it has a specific educational bearing on the student's major or minor subjects of study.

A student who elects a miscellaneous course is required to register in it, do the work, and pass the semester examinations, unless he is permitted to withdraw under the rules. A student who has a listener's card is not permitted to participate in the classwork or the examination.

No student may register for a full minimum program of work for graduate credit if it is necessary for him to carry at the same time more than one miscellaneous subject and to visit one course.

Students on the Staff.—Assistants and others on the University staff who undertake to do graduate work are permitted to take an amount of work

determined by the terms of their employment. Such a student, if required by his engagements to teach more than five classes a week or to have laboratory work or supervision exceeding ten hours a week, may not receive his master's degree at the end of one year, nor his doctor's degree at the end of three.

The enrollment of a member of the staff is subject to the approval of the officer to whom he is responsible as a member of the staff and of the Dean of the Graduate School with reference to the amount of work to be taken. Before credit may be recorded for such graduate student at the end of a semester, the head of the department in which he is employed, or some one authorized by the head, must certify that the time given to graduate work by the student has not impaired the work for which he is paid by the University.

Residence and Work Done Elsewhere.—Continuous residence and study are required of all members of the Graduate School, unless they are granted leave of absence by the Dean, upon recommendation of the professor in charge of their work, for the purpose of carrying on elsewhere studies or investigation in the line of work for their degrees.

Students should note that all the work for the master's degree must be done in residence at the University, excepting in the case of members of the staff who have spent half of their time in study through a year at some other institution, and then do the rest of the work required during a year in residence here. This privilege is extended also to high school teachers residing and employed in Urbana or Champaign.

Credit for work done elsewhere is not transferred. The candidate is examined here on all the work required for the degree.

Withdrawal.—If after registration a graduate student wishes to withdraw from any course or to add other work, he must first secure the necessary papers from the Dean's office. See the regulations concerning changes in study lists, page 11. If he wishes to withdraw from the University he must get clearance papers at the Dean's office.

DEGREES

Masters' Degrees

Character of Master's Degrees.—The master's degree conferred depends upon the character of the bachelor's degree. The usual practise is that A.M. shall follow A.B., that M.S. shall follow B.S. However, this practise may be departed from in cases where the undergraduate course of study of the candidate was of a kind for which some reputable institutions in this country give A.B., while others give B.S. Such departure from the regular practise is permitted, however, only on individual petition duly approved.

Amount of Work Required.—Candidates for the degree of Master of Arts or Master of Science are required to do at least one full year's work in residence, including a thesis. By this is meant from four to five unit courses each semester, or their equivalent. A unit course is one which requires ten hours of time a week through one semester, or a minimum of 180 hours, irrespective of the mode of distribution of that time in class work, laboratory work and

private study. Four such courses or their equivalent constitute a full *minimum* program for one semester, and eight such courses, or their equivalent, constitute the *minimum formal* year's work accepted for a master's degree. Only first rate students are permitted to secure a degree with this minimum program.

Unless otherwise permitted, on individual petition duly approved, every student must take each semester at least one course open to graduate students only (courses numbered 100 and upwards).

In the first year of his graduate study each student is required to attend a minimum of four formal class, lecture, or laboratory exercises a week. In no case is he permitted during his course to attend more than twelve a week, without permission.

Grades.—Student's work is graded in five classes, A, B, C, D and E. The last indicates a failure. D indicates unsatisfactory, though passable, work. The degree will not be awarded to any student who does not secure a grade of B or higher in three-fourths of the work (number of units) for the degree, including his thesis.

A failure or absence from examination in any course may prevent the conferring of the degree; and, as already indicated, failure in any course in the major field precludes the conferring of the degree in the same year.

Majors and Minors.—A candidate for a master's degree may do all his work in one subject, or he may select a major and one minor, or a major and two minors. A major or minor denotes the field of knowledge of a department, or such part thereof as constitutes a separate and independent division of that field. For a master's degree a major is at least half the work, or a minimum of four units, for one year. Less than one unit may not be counted as satisfying the requirements of a minor without the approval of the department concerned.

A program of studies for a first-year graduate student which is limited exclusively to the investigation of a single problem will not be approved.

Foreign Language.—The ability to use one or more of the modern languages ordinarily studied in the undergraduate curriculum is expected of all candidates for the master's degree, and in some lines of study is required. On this matter students should consult the heads of the departments in which their major subjects lie.

Master's Thesis.—Each candidate for a master's degree is required to present a thesis on some subject approved by the professor in charge of his major work and the Executive Faculty of the Graduate School. The requirement of a thesis may be waived, however, upon the recommendation of the head of the department in which the student is doing his major work and the approval of the Dean, provided application to waive the thesis is made at the beginning of the year. *In no case will permission to take the degree without the thesis be given by the Dean if applied for later than the latest date for the approval of thesis subjects, as shown by the calendar.* A student excused from writing a thesis must replace it with additional courses of instruction.

No one will be excused from writing a thesis unless one-half of his program of studies consists of courses numbered 100 and upwards.

Students working for their masters' degrees in the summer session must announce their thesis subjects not later than the beginning of their third session in residence.

Students who expect to take their Masters' degree in October and February must announce their thesis subjects not later than two months after their first enrollment.

The thesis required from a candidate for a master's degree ordinarily will demand one-fourth of the student's time and may not exceed one-third of it. The thesis must be typewritten, on "thesis paper,"* and the title page must be printed. The thesis in its final form, together with a certificate of approval by the proper officer, must be left by the professor in charge at the Dean's office at the time set in the calendar. No article prepared for another use, or previously published, will be accepted as a thesis.

Under proper conditions a student may be permitted to complete the last fourth of his work, if devoted to his thesis, under leave of absence. To get such permission the student must have secured credit for at least six units; must petition for the privilege; must submit to the Dean an outline of the proposed investigation, approved by the head of his major department; and must submit satisfactory evidence that adequate facilities are available to him at the place where he intends to do the proposed work. Approval on all these points must be obtained one collegiate year before the thesis is due.

Graduate Study in the Summer.—Graduate students in the summer session are subject to the same scholastic requirements as those in the regular University year. Their study lists must be approved by the Dean of the Graduate School, or his representative. Attendance on four summer sessions of nine weeks each, or one semester and two summer sessions of nine weeks each, is considered the equavalent of one year in residence. If in these sessions the required amount of work is properly done a master's degree may be earned in this way. The faculty is unwilling to accept summer-session work beyond the master's degree towards the doctor's degree, except in the case of a student who works in a summer session preceding or following a regular year's attendance at the University. In no case may the last year's work for the doctorate be done in disconnected summer sessions.

No course offered in the summer session may be taken for credit towards a higher degree unless it is specially described in the summer-session circular as accepted for that purpose.

Graduate students in the regular summer session period are credited with only 8 weeks towards the fulfillment of the time requirement for the master's degree. It is necessary, therefore, for those who take work through four summer sessions for this degree to complete the residence requirement of thirty-six weeks by taking four additional weeks. This may be done at any summer session by continuing work after the close of the regular session, un-

*No other will be accepted by the Dean. "Instructions for the preparation of theses" may be obtained at the Dean's office.

der the direction of the instructors with whom the student is working. The student is examined on the work thus done as on all other work, and must report his additional work to the Dean.

Summer Work in Medical Sciences.—Graduate courses in medical sciences are offered in the summer quarter between June and September at the College of Medicine of the University of Illinois in Chicago. Circulars describing the courses offered and conditions of admission and work may be obtained from the Secretary of the College of Medicine, Congress and Honore Streets, Chicago.

Marine Biological Laboratories.—Students in zoology, candidates for the master's degree, part of whose necessary preparation is experience in a marine or fresh-water biological laboratory or station, are permitted to offer, in part fulfillment of the requirements for the master's degree, work done in such fresh-water or marine laboratory; provided that the student who wishes to have such work accepted make application before beginning work in such laboratory; that the selection of the laboratory at which he is to work has been approved by the faculty beforehand; that the time to be spent in such work be not less than six nor more than nine weeks in any one summer; that the instructors under whom the student is to work have been previously accepted by this faculty; that he submit to an examination here on the work done at such laboratory; and that a certificate of attendance from a proper officer of the laboratory or station be submitted and a full written report of the work done in the shape of notes, or otherwise, be required; and that the student shall be in residence here at the University for one full academic year during which he shall do the rest of the work necessary for his degree.

The marine biological laboratories which have thus far been approved as institutions at which students of this University may take work for record here are:

Marine Stations:

Marine Biological Laboratory, Woods Hole, Massachusetts
Harpswell Marine Laboratory, Casco Bay, Maine
Puget Sound Station, Friday Harbor, Washington
Hopkins Marine Laboratory of Stanford University, Pacific Grove, California
Scripps Institute for Biological Research, University of California. LaJolla, California
Carnegie Institution Laboratory, Dry Tortugas, Florida
Bermuda Biological Station, Bermuda
Brooklyn Institute Biological Laboratory, Cold Spring Harbor, L. I.

Fresh-Water Stations:

Douglas Lake Station, University of Michigan, Topinabee, Michigan
Ohio State University Laboratory, Cedar Point, Ohio
University of Wisconsin Lake Laboratory, Madison, Wisconsin.

Similar arrangements are made, under similar conditions, for students of geology in connection with Geological Surveys.

Masters' Degrees in Engineering

Two classes of second degrees are open to graduate of the College of Engineering, namely, academic and professional.

The academic second degree in engineering is Master of Science, following Bachelor of Science, in architecture, architectural engineering, civil engineering, electrical engineering, etc. This degree is conferred in accordance with the regulations described above for *academic work in residence only.*

The *professional* second degrees in engineering are as follows:

Master of Architecture, after B. S. in architecture.

Architectural Engineer, after B. S. in architectural engineering.

Civil Engineer, after B. S. in civil engineering or B. S. in municipal and sanitary engineering.

Electrical Engineer, after B. S. in electrical engineering.

Mechanical Engineer, after B. S. in mechanical engineering.

Engineer of Mines, Civil Engineer, Electrical Engineer, or Mechanical Engineer, after B. S. in mining or railway engineering, according to the course.

Professional degrees are conferred on two classes of candidates: (1) graduates of the College of Engineering of the University of Illinois who have been engaged in acceptable professional work away from the University for a period of not less than three years after receiving the degree of Bachelor of Science; (2) graduates of the University of Illinois, or of institutions of equal standing, who have been engaged in acceptable professional work in residence at the University for a period of not less than three years after receiving the degree of Bachelor of Science.

In "acceptable professional work" may be included contributions to technical literature, activity in professional societies, investigation of engineering problems, and the teaching of engineering subjects.

A candidate must declare his candidacy and file with the Dean of the College of Engineering, as chairman of the committee in charge, a detailed statement covering his professional study and experience, not later than the first Monday in November preceding the commencement at which he proposes to qualify. Prior to December 31 next succeeding, he must submit for approval an outline of his proposed thesis and he must file his completed thesis not later than April 1. If the statement of professional experience and study and the thesis are accepted, the candidate must present himself at commencement in order to receive the degree.

Candidates for professional engineering degrees who already hold the degree of Master of Science may qualify for the professional degree after two years of professional work.

A candidate for a professional engineering degree must pay the incidental fee of thirty dollars on being notified that his professional study and experience are accepted as qualifying him to enter as a candidate for the degree. No one will be enrolled as a candidate for the degree at the following commencement who does not pay his fee at this time. When a candidate for a professional engineering degree has once been accepted and paid his fee, he is eligible

to receive the degree at any time within five years, without additional fee, on completion of the requirements; provided, however, that unless he completes the requirements within two years his name will be dropped from the list of candidates and in order to receive the degree within the five-year period he must register once more.

The Degree of Doctor of Philosophy

Majors and Minors.—The requirements for the degree of Doctor of Philosophy are a thoro mastery of a selected field of study, evidence of the power of independent investigation in this field, a broad knowledge of the wider field of study of which this major subject is a part, a general acquaintance with related fields of knowledge, and a mastery of all branches of study which are necessary to a full knowledge of the main subject. Each student who is seeking this degree is expected to choose for study and final examination a major subject, or field of study, and a first and second minor. The major subject is the field in which the student expects to become expert and an authority. The first minor must be a subject closely related to the major and may, under certain conditions and with proper approval, be a subdivision of the major field of study. The second minor should be chosen outside of the major field of study, and must be so chosen by a candidate who elects a division of his major field for his first minor.

For the doctor's degree no definite division of a student's time among major and minors can be made, to hold in all cases. In general the faculty approves an arrangement which, distributing the student's time through the required three years, divides it equally among his three subjects in his first year of graduate study; in the proportion of two to one, as between his major and first minor, in the second year of graduate study (his second minor being finished and dropped at the end of the first year); and gives all his time to his major during his third year.

To put the matter in another way, a course of graduate grade (from among the "hundred" courses) meeting twice or three times a week, corresponding roughly to what is sometimes called a full course, or in our terminology a unit course, running through the year, should ordinarily be sufficient for a second minor; a similar course running through two years should ordinarily be sufficient for a first minor.

While "full-time work" in the first year of graduate study, leading usually to a master's degree, is at least eight units for the two semesters, full-time work after the first year is not reckoned in units. The student is simply required to devote all his time to his work. Nor is there any necessary correspondence between the number of courses taken and the number of units required in the first year, or full-time work in any year. A first-year student might possibly secure all the credit necessary in two or three courses; and a second-year or third-year student might conceivably be devoting all his time to one course and his research or to his research alone.

Period of Study.—The *minimum* period of study required for securing the degree of Doctor of Philosophy is three years, during which the student is re-

quired to devote all his working time to his studies. All three years must be spent in residence at some accredited educational institution and either the first two or the last one of the three must be spent at the University of Illinois. The degree is conferred, however, not for residence during a certain period, but for scholarly attainments and power of investigation, as proved by thesis and examinations.

Credit for work done in other universities is not "transferred." The candidate is examined here on the subjects offered by him for the advanced degree. However, his period of residence at another institution of proper grade may be accepted in fulfillment of the residence requirement of the University of Illinois, so far as it goes.

Preliminary Examination.—Towards the end of his second year of study, or, by special permission, at the beginning of his third year, the candidate for the degree must submit to a preliminary examination, in order to determine whether he will be accepted as a candidate for the degree in the following year. This examination is intended to test the student's knowledge of the fields of his major and minor subjects of study only. It is partly oral, and may be wholly so.

The student will not be admitted to his preliminary examination until the faculty is satisfied that he has finished substantially the equivalent of two years' graduate work. He must do a full year's graduate work between his preliminary examination and the completion of his work for the doctorate.

Language Examination.—The candidate will be required to demonstrate his ability to read French and German and other languages needed in his work. This test of proficiency in the use of French and German takes place not later than the time of the preliminary examination for admission to candidacy.

Final Examination.—On or before the last Monday in May of the year in which the candidate expects to come up for his degree, he must submit to a final examination, given by a committee appointed by the Dean. This examination is primarily on the research work of the student, as embodied in his thesis, but it is not confined to that. It extends to the whole field of the study of the candidate. It will not be confined to the courses which the candidate has attended in the University of Illinois only, if he has done part of the work elsewhere; nor even to the field covered by the courses specifically taken in this or other universities; but will be so conducted as to determine whether the candidate has a satisfactory grasp of his major subject as a whole, and a general acquaintance with the fields of knowledge represented by his course of study.

The final examination may not be divided. The examination must be taken all at one time even tho it requires several sessions.

Other Examinations.—Before the candidate is admitted to the final examination and the defense of his thesis, he may be required to take any other examination, oral or written, that is thought proper by the various departments in which he has studied. If, after having passed his preliminary examination, he fails in the third year of his study to meet the expectations of the

professors in charge of his work, or in any way fails to maintain the standard of scholarship and power of research expected of him, he may be refused admission to the final examination.

The above examinations are in addition to those in the courses for which the student is registered. These must be taken at the times for which they are set in the examination schedule.

No candidate who does not secure a record of B or higher in at least three-fourths of his work will be recommended for the degree.

Thesis.—The power of independent research must be shown by the production of a thesis on some topic connected with the major subject of study. The candidate is expected to defend his thesis or dissertation before the members of the faculty, or as many of them as may wish to question him about it, in connection with his final examination.

The subject of the thesis should be chosen not later than the end of the second year of study and must be submitted for formal approval by the faculty not later than the first Monday of November of the year when the degree is expected. Unless previously printed with proper authority, a typewritten copy of the complete thesis, *on thesis paper**, must be in the hands of the Dean not later than noon of the Saturday nearest the middle of May, for submission to the examining committee.

The doctor's thesis must be printed and one hundred copies deposited in the Library of the University by the candidate, not later than the first of June preceding the conferring of the degree. In form, the printed thesis must follow the "instructions for the preparation of masters' and doctors' theses," copies of which may be obtained at the Dean's office on application. If it is not printed by the first of June, the student must, not later than that date, deposit seventy-five dollars ($75) or a bond for that amount satisfactory to the Comptroller of the University and the Dean of the Graduate School. A member of the faculty of the University of Illinois will not be accepted as a guarantor on such a bond. If a bond is accepted, it must be replaced at the end of one year with a cash deposit. At the end of two years, if the thesis has not then been printed by the student, the University will print it or such part of it as is deemed best.

The cash deposit made by the student who does not print his thesis by the end of the second year after his degree is conferred becomes the property of the University, to be used for the general purpose of printing theses.

The title-page of each thesis, whether typewritten or printed, must bear the words, "Submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in—[here put the major subject]—in the Graduate School of the University of Illinois." The title-page must also contain the full name of the author, his previous degrees, the full title of the thesis, the year of imprint and, if a reprint, the title and volume and a statement of the pagination of the volume from which it is reprinted. Each thesis must have an appendix giving a short biography of the candidate, including the institutions

*No other will be accepted by the Dean.

he has attended, his degrees and honors, the titles of his publications, and such other matters as are pertinent.

Doctor's Degree in Engineering.—The degree of Doctor of Philosophy in Engineering is offered in certain lines of academic work of a high scholastic type in engineering science for students who wish to prepare themselves as teachers, investigators, and experts.

The general requirements for this degree, as to preliminary education, linguistic attainments, etc., are the same as in other lines.

The following lines of engineering science are open as majors:

Engineering mechanics
Steam engineering
Hydraulic and sanitary engineering
Electrical engineering
Heating and ventilation engineering
Railway engineering
Masonry construction and structural engineering
Coal-mining engineering

The first minor may be any of the above or one of the following fundamental sciences or an authorized combination of two of them:

Theoretical mechanics
Mathematics
Thermodynamics
Chemistry
Geology
Physics (Experimental or mathematical)
Zoology
Botany

The second minor should be in other than engineering subjects.

SCHOLARSHIPS AND FELLOWSHIPS

A number of scholarship and fellowships have been established by the Trustees of the University. To first-year graduate students of ability and promise there are open a number of scholarships with a stipend of $300 each and freedom from tuition, incidental, and laboratory fees. To second-year and third-year graduate students, that is, those who have had one or two years of graduate study, there are open fellowships with a stipend varying from $350 to $500, with freedom from the above-mentioned fees. The larger stipends are given only to students who are expected to take their degrees within the year. Each holder of a fellowship or scholarship must pay the matriculation fee of ten dollars, unless he holds a first degree from the University of Illinois, and also the diploma fee of five dollars on receiving his diploma.

Candidates for these scholarships and fellowships must be graduates of the University of Illinois, or of colleges or universities having equivalent requirements for bachelors' degrees.

Application must be made on blanks to be obtained from the Dean of the Graduate School. These application forms should be sent to the Dean of the

Graduate School as early as possible in February of the academic year preceding that for which the fellowship is desired. No application will be considered if received later than March first, until after April fifteenth, the date when appointees from the first list of applicants must accept or refuse their appointments.

Persons appointed are notified on April first and must send the Secretary of the Board of Trustees notice of their acceptance or refusal by April fifteenth; and must agree that, if accepted, the appointment will not be resigned to take a similar one in any other institution during the year for which it is awarded.

Nominations to fellowships are made on the grounds of worthiness of character, scholastic attainments, and promise of success in the principal line of study or research to which the candidate proposes to devote himself. Scholarships and fellowships are not given to candidates who are over thirty years of age at the time when the appointment is to be made.

For second-year fellowships, adequate preparation in French, and for third-year fellowships, adequate preparation in French and German is required.

An appointment as honorary fellow, without stipend, may be made as specified for paid fellowships in the case of any one who has shown distinguished merit in his work.

LIBRARIES

The general University library, the library of the State Laboratory of Natural History, that of the State Geological Survey, and that of the College of Law are all at the University in Urbana. The libraries of the School of Pharmacy and the College of Medicine are in Chicago.

These libraries contain 423,063 volumes, and 105,347 pamphlets. Of these, 407,733 books and 49,318 pamphlets are in the libraries at Urbana; the rest are in Chicago. The library at Urbana also contains 2,042 maps and 4,718 pieces of sheet music. The departments at Urbana currently receive 5,268 periodicals, while the College of Medicine and School of Pharmacy in Chicago receive 244.

The general library of the University is open daily, from 8 a. m. until 10 p. m. and on Sunday from 2 p. m. to 6 p. m.

The Mason Historical Library.—The library of western history collected by Edward G. Mason, Esq., long President of the Chicago Historical Society, is in the public library of the city of Champaign, and is accessible to University students.

The Dittenberger Classical Library.—The University possesses the library of Wilhelm Dittenberger, at one time Professor of Classical Philology in the University of Halle. This library contains 5,600 items. It includes the works of the poets and prose writers, numerous works on grammar and history of literature, and between four and five thousand dissertations and programs on special topics. There are also many works dealing with other departments of

classical philology, as epigraphy, history of ancient peoples, archeology, philosophy, history of art, geography, chronology, metrics, etc.

The Heyne Library of Germanics.—The library of Professor Moritz Heyne of the University of Göttingen was bought by the University. It contains about 5,200 volumes. The collection is rich in the general field of German philology and in lexicography. It has many rare first editions of works of German literature from the sixteenth, seventeenth, and eighteenth centuries and has sets of a number of rare periodicals.

The Gröber Library in Romance Languages.—The University also possesses the library of Professor Gröber of the University of Strassburg. This library contains about 6,500 titles.

The Vahlen Library, of the late Johannes Vahlen, contains about 10,000 volumes and is in itself an excellent working library in classical philological literature. It is well supplied with texts of Greek and Latin authors.

The Aron Library, collected by the late teacher and student of pedagogy, R. Aron, contains about 20,000 volumes. It is a scholarly collection of educational documents, among them many original and early editions, and furnishes firsthand material for the study of educational movements in Europe, especially in Germany, from the time of Luther and Comenius to the present. The collection of German "Fibeln" or school readers is unique, and the material for the history of juvenile songs and literature, the set of 17th and 18th century atlases, and the collection of rare hymn books and juvenilia make the collection very useful to students of education.

FEES AND EXPENSES

Except as noted below, graduate students pay fees as follows:

Matriculation fee	$10.00
Incidental fee, each semester	15.00
Diploma fee	5.00
For late registration	1.00
For change in study-lists	1.00

All graduate students who have not matriculated as undergraduates at the University of Illinois pay the matriculation fee on entrance.

All graduate students pay the diploma fee.

No tuition or incidental fee is charged for graduate courses to scholars, fellows, or members of the corps of instruction or the staffs of the University libraries or of the scientific bureaus or experiment stations, who are appointed by the Board of Trustees, nor for undergraduate courses on their study-lists if approved by the heads of the departments and by the Dean of the School as necessary or desirable for the proper completion of the work for the degree. Otherwise graduate students who take undergraduate courses must pay the proper undergraduate fee.

Each student working in the laboratories, or in the drafting or engineering classes, is required to make a deposit of from 50 cents to $10.00, to pay for

chemicals and apparatus used, and for any breakage or damages. But no charges or deposits for laboratory materials are required from scholars, fellows, or members of the corps of instruction or scientific staffs mentioned above.

Table board may be obtained at prices ranging from $6 a week.

Room rent, with two in a room, ranges from $2.50 a week.

THE GRADUATE CLUB

The Graduate Club is an unofficial organization of the graduate students and faculty. Its purpose is to furnish an opportunity for those working in different departments to become acquainted with one another and thus counteract the tendency toward narrowness which intense specialization may sometimes induce.

DEPARTMENTS OF INSTRUCTION

Courses open to graduate students are of two classes. The first class is wholly of graduate grade, and the courses are numbered 100 upwards. The second class includes the courses classified as for graduates and advanced undergraduates. These carry numbers below 100. The courses numbered 100 and upwards are all accepted for major credit. Those of the other group are in many cases accepted only for minor credit. This is especially true of courses which are open to juniors.

All courses have certain prerequisites for admission. Inasmuch as the prerequisite preparation may be gained at other institutions from courses differing from those offering a similar preparation at the University of Illinois, so that a statement of prerequisites as given here would not be understood elsewhere, their description is omitted altogether. However, a student who wishes to enter a particular course must satisfy the department concerned that he has had in some form the prerequisites for admission to the course.

For the convenience of first-year students the credit value of graduate courses is given in units. These values have no significance for second-year and third-year students.

The credit received for "courses for graduates and advanced undergraduates" is in accordance with the regulations of the Graduate School circular, page 12.

Students are admitted to graduate standing in agriculture who have had a thoro training in the sciences underlying agriculture, and who are otherwise eligible to the Graduate School, even tho their undergraduate course of study lacked to some extent the amount and kind of technical work in agriculture included in the course of study for the bachelor's degree in agriculture at the University of Illinois.

ACCOUNTANCY

These courses may be taken for second minor credit only. They may be chosen only by students who have had at least two years' previous training in accountancy and whose major subject is economics (including commerce), business organization, railway administration, engineering, or agriculture.

Courses for Graduates and Advanced Undergraduates

3a-3b. Accounting Problems and Auditing.—Must be taken throughout the year in order to secure credit. *Three times a week; both semesters.*

Professor Scovill

4a-4b. Cost Accounting.—(a) Cost accounting applied to factory procedure, overhead expense, the installation and control of cost systems, presentation of cost data; (b) as a basis for manufacturing efficiency; (c) the construction of cost systems. *Twice a week; both semesters.*

Professor Scovill

5a-5b. C. P. A. PROBLEMS.—Representative problems of various types, including questions on theory of accounts and auditing. The second semester may not be taken without the first. *Twice a week; both semesters.*

Professor SCOVILL

13a-13b GOVERNMENTAL ACCOUNTING.—*Twice a week; both semesters.*

Assistant Professor MOREY

20. INCOME TAX PROCEDURE.—Application of the requirements of the Federal income, excess-profits and war-profits taxes. *Twice a week; second semester.* Assistant Professor FILBEY

AGRONOMY

Students taking their major work in agronomy must have had the major courses in agronomy offered to undergraduates in the College of Agriculture of the University of Illinois, or their equivalent. Graduate students may specialize either in soils or in crops. Courses 7, 11, and 12, or the equivalent, will be required of graduates who specialize in soils and courses 7, 12, and 22, or the equivalent will be required of those specializing in crops. While everyone seeking a doctor's degree with agronomy as a major will be required to have a general knowledge of the whole field of agronomy, each student is expected to prepare a thesis in some one of the divisions, soil fertility, soil physics, soil biology, plant breeding, crop production or farm mechanics.

Students who are taking their major work in other departments and choose agronomy as a minor, must have had previously the work in chemistry, botany, and other fundamental sciences prescribed for the undergraduate courses in agronomy in the College of Agriculture, or the equivalent.

Courses for Graduates

101. SOIL INVESTIGATIONS.—System of soil investigations; sources of error and methods of control; interpretation of results. *Twice a week; both semesters. One unit.* Professor STEWART

104. SEMINAR IN AGRONOMY.—*Once a week; both semesters. Half unit.*

Associate Professor WHITING and others

112. PLANT BREEDING.—Experiments at this station; methods and results reported from other states and from foreign countries. *Twice a week; both semesters. One-half to two units.* Professor SMITH

114. CROP PRODUCTION.—Crop ecology; methods and results of crop production investigations. *Once a week; both semesters. One-half to two units.*

Professor BURLISON

118. INVESTIGATIONS.—A special problem is chosen by each student. *Consultation one to five times a week for different students; both semesters. One to four units.* Professors HOPKINS, SMITH, MOSIER, STEWART, BURLISON AND WHITE

Courses for Graduates and Advanced Undergraduates

7. ADVANCED FARM CROPS.—Climatic and soil factors; rotation; distribution of labor; cost of production; pure seed production; supply and consump-

tion of products and by-products; storage and marketing. *Three times a week; second semester.* Professor BURLISON

11. SOIL BIOLOGY.—Biochemical activities of soil microorganisms in relation to soil fertility. *Five times a week; second semester.*

Professor WHITING

12a. SOIL FERTILITY, FERTILIZERS, ROTATIONS.—The influence of fertility; effect of different crops on the soil and on succeeding crops. *Twice a week; second semester.* Professor HOPKINS

22. PLANT BREEDING.—Improvement of field crops; selection. *Twice a week; second semester.* Professor SMITH

23. PLANT FOOD SUPPLIES.—The world's supply of plant food materials; utilization and conservation. *Twice a week; second semester.*

Professor STEWART

ANIMAL HUSBANDRY

Students entering graduate work in animal husbandry must have a thoro training in the fundamental principles of the subject either in connection with or in addition to a course of study in agriculture substantially equivalent to that offered in this University.

Courses for Graduates

103. LIVE STOCK EXPERIMENTATION.—Objects, methods, and the sources of error in experimental work dealing with the feeding, breeding, and management of farm animals. *Once a week; second semester. One-half unit.*

Professor DAVENPORT

110. ANIMAL NUTRITION.—Biochemistry, digestion, metabolism, and nutritive value of proteins. *Twice a week; both semesters. One unit.*

Professor GRINDLEY, Assistant Professor MITCHELL

111. ANIMAL NUTRITION.—Biochemistry, digestion, metabolism, and nutritive value of fats and liquids, carbohydrates, and inorganic substances. *Twice a week; both semesters. One unit.* (Not given, 1919-20).

Professor GRINDLEY, Assistant Professor MITCHELL

112. RESEARCH.—Investigations along the following lines:

(a) Economic factors involved in meat production.

Professor MUMFORD, Professor COFFEY, Professor RUSK

(b) Systems of live stock farming. Profesor HANDSCHIN

(c) The valuation of pedigrees. Professor MUMFORD

(d) Animal nutrition. The chemistry of feeding stuffs; metabolism experiments and biochemical studies connected with the nutrition of farm animals.

Professor GRINDLEY, Assistant Professor MITCHELL

(e) Genetics. Problems in heredity and variation. Professor DETLEFSEN

(f) Factors affecting the quality, quantity, strength, and condition of wool.

Professor COFFEY

(a), (b), (c), and (f), one to three times, (d) and (e), five times a week; both semesters. One to two units. These courses may be taken during the summer by special permission.

116. SEMINAR IN ANIMAL HUSBANDRY.—*Once in two weeks; both semesters.* Members of the department

117. GENETICS.—Genetic experiments; biological and mathematical methods employed; the validity of the conclusions. *Two to five times a week; both semesters. One to two units.* Professor DETLEFSEN

Courses for Graduates and Advanced Undergraduates

7. PRINCIPLES OF ANIMAL NUTRITION.—*Five times a week; first semester.* Assistant Professor MITCHELL

22. ADVANCED STOCK JUDGING.—Animal conformation with reference to market and show yard form; quality and condition. *Five times a week; first semester.* Various members of the department

24. MEAT.—Influence of type, condition, age, sex, and feeds on the yield and market grade of meat products. *Once a week; second semester.* Professor COFFEY

26. SWINE.—The economical production of pork. Problems and methods. *Once a week; second semester.* Mr. RICE

27. SHEEP HUSBANDRY.—The industry in leading sheep growing countries and particularly in different parts of the United States. *Once a week; second semester.* Professor COFFEY

28. ADVANCED HISTORY OF BREEDS OF LIVE STOCK.—Methods of prominent breeders, and performances of great individual animals; beef, horses, sheep, and swine. *Once a week; first semester.* Professor MUMFORD and other members of the department

29. SYSTEMS OF LIVE STOCK FARMING.—Farm management applied to live stock farming. *Twice a week; second semester.* Professor HANDSCHIN

30. GENETICS.—Heredity and variation. *Daily; second semester.* Professor DETLEFSEN

31. ADVANCED COURSE IN ANIMAL NUTRITION.—Digestion; histology and composition of body tissues; metabolism of food nutrients; effect of food nutrients on metabolism; the fasting catabolism; food requirements and feeding standards; growth; nutritive value of proteins and amino acids. *Five times a week; second semester.* Assistant Professor MITCHELL

32. MARKETING LIVE STOCK.—*Twice a week; second semester.* Professor MUMFORD

ARCHITECTURE AND ARCHITECTURAL ENGINEERING

The prerequisite for graduate work in architecture and architectural engineering is the equivalent of the undergraduate courses required at the University of Illinois for the degree of Bachelor of Science in architecture and architectural engineering in the branches of the subjects in which registration is desired.

Courses for Graduates

101. ARCHITECTURAL CONSTRUCTION.—Design of special structures. *Twice a week; both semesters. One-half to one unit.* Professor RICKER and Professor PROVINE

103. Advanced Architectural Graphics.—*Twice a week; both semesters. One to two units.* Professor Provine

104. Architectural Design.—Advanced course. *Twice a week; both semesters. One to four units.* Associate Professor Curtis

105. Architectural Practise.—Contracts, specifications, and office methods. *Twice a week; first semester. One-quarter to one-half unit.* Professor Provine

ASTRONOMY

The prerequisites for graduate study in astronomy are mathematics through the calculus, a year's course in observational astronomy, and a course in college physics.

Courses for Graduates

101. Seminar. *Three times a week; both semesters. One unit.* Professor Stebbins

102. Stellar Astronomy.—Orbits of binary stars; variable stars; theoretical photometry. *Three times a week; both semesters. One unit.* Professor Stebbins

Courses for Graduates and Advanced Undergraduates

7-8. Theoretical Astronomy.—Celestial mechanics; theory of orbits. *Three times a week; both semesters. One unit.* Professor Stebbins

14. Observational Astronomy.—The working methods of an astronomical observatory. *Three times a week; second semester. One unit.* Professor Stebbins

15. Geodetic Astronomy.—The sextant, transit, and zenith telescope; methods similar to those of the United States Coast Survey. *Three times a week; first semester. One unit.* Professor Stebbins

BACTERIOLOGY

Instruction in bacteriology is offered by the departments of agronomy, botany, chemistry, and dairy husbandry. The work is offered under the supervision of a committee representing these departments.

Students who take a major in bacteriology must have had 10 semester hours of bacteriology and 15 semester hours of chemistry. The thesis may be chosen in any one of the following fields: general bacteriology, bacteriology of the dairy, of soils, of water and sewage, of animal diseases, or of plant diseases.

Candidates for the doctor's degree, with a major in bacteriology, will be held responsible for a general knowledge of all of the above mentioned fields in bacteriology.

A candidate for the doctor's degree, with a major in some field other than bacteriology, who elects a first or second minor in bacteriology must offer a minimum of four units for the first minor and a minimum of three units for the second minor selected from the courses listed below.

Courses for Graduates

BACTERIOLOGY

103. PHYSIOLOGY OF BACTERIA.—Fermentation; growth and death of bacteria. *Once a week; first semester. One unit.* Assistant Professor TANNER

105. CLASSIFICATION OF BACTERIA.—Variability of species; characters; mutations; standard and biometrical classification. *Once a week; second semester. One unit.* Assistant Professor TANNER

107. RESEARCH.—(For those students who are taking a major in bacteriology either for the doctor's degree or the master's degree. Thesis work may be taken in any of the fields indicated below.) *Once a week; both semesters. One-half unit to four units.*

GENERAL BACTERIOLOGY — Assistant Professor TANNER
DAIRY BACTERIOLOGY — Professor HARDING
PATHOGENIC BACTERIOLOGY — Assistant Professor TANNER
PLANT PATHOLOGY — Professor STEVENS
WATER AND SEWAGE BACTERIOLOGY. — Professor BARTOW

AGRONOMY

118. INVESTIGATIONS IN SOIL BIOLOGY.—Special problems. *Consultation one to five times a week for different students; both semesters. One to four units.* Professor WHITING

CHEMISTRY

110. WATER SUPPLIES.—Sources of contamination of water supplies; purification of water for potable or technical use. *One to five times a week; both semesters. One-half to one and one-half units.* Profesor BARTOW

DAIRY HUSBANDRY

104. SCIENTIFIC READINGS.—Discussion of bacteriological problems based on selected German or French texts. (Recommended for first and second year students.) *Once a week; both semesters. One-half unit.* Professor HARDING, Associate Professor PRUCHA

105. BACTERIOLOGICAL LITERATURE.—Each student is required to prepare and deliver an acceptable course of lectures. (Recommended for second year and third year students.) *Once a week or once in two weeks; both semesters. One-half or one unit.* Professor HARDING

106. RESEARCH ON ASSIGNED PROBLEMS.—Open to graduate students whose development permits their undertaking problems of dairy bacteriology with only general supervision. *Once a week; both semesters. One-half unit to two units.* Professor HARDING, Associate Professor PRUCHA

Courses for Graduates and Advanced Undergraduates

BACTERIOLOGY

8. APPLIED BACTERIOLOGY.—Water, sewage, and food bacteria. *Five times a week; second semester.* Assistant Professor TANNER

18a-18b. JOURNAL MEETING.—Required of all students majoring in general and pathological bacteriology. *Once a week; both semesters.*
Assistant Professor TANNER

20. GENERAL BACTERIOLOGY.—For seniors and graduate students who do not take bacteriology as a major. Assigned readings in foreign literature. *Five times a week; first semester.* Assistant Professor TANNER

26. PATHOLOGICAL BACTERIOLOGY.—Cultural and morphological characteristics of disease-producing organisms; immunity and serum reactions; routine diagnostic procedure. *Three times a week; first semester.*
Assistant Professor TANNER

AGRONOMY

11. SOIL BIOLOGY.—Biochemical activities of soil microorganisms in relation to soil fertility. *Five times a week; second semester.*
Professor WHITING

BOTANY

22a. MORBID HISTOLOGY.—Histology of the plant tissues; parasites in condition of disease. *Once a week; first semester.* Professor STEVENS

22b. BACTERIAL PLANT DISEASES.—*Once a week; second semester.*
Professor STEVENS

CHEMISTRY

10a. STUDY OF WATER SUPPLIES.—History, sources, contamination, and standards of purity of potable waters and waters for industrial purposes; analytical methods. *Three times a week; second semester.* Professor BARTOW

DAIRY HUSBANDRY

10. DAIRY BACTERIOLOGY.—Study of some of the more important relations of bacteria to milk and its products. Lectures; laboratory. *Three times a week; second semester.* Professor HARDING

11. DAIRY BACTERIOLOGY.—Bacteria in milk and its products; sources, effect on milk, and method of control. *Twice a week; first semester.* (Not given, 1919-20.) Professor HARDING

12a-12b. DAIRY BACTERIOLOGY. Laboratory work supplementing Dairy Husbandry 11. *Four times a week; both semesters.* (Not given, 1919-20.)
Professor HARDING

BOTANY

Candidates for advanced degrees in botany must offer for admission at least 20 hours in university botany, or 15 hours in botany and 5 hours in zoology or in entomology.

Graduate students who desire to elect botany for minor credit must offer the equivalent of 10 hours in university botany as well as any other stated prerequisites to the courses selected.

Courses for Graduates

101. INDIVIDUAL PLANT DEVELOPMENT.—Origin of the individual; external and internal factors in its development and physiologic performance;

response of the cell, somatic and generative, to external factors. *Once a week; both semesters. One-half to two units.* Professor HOTTES.

102. PHYSIOLOGY.—Effects of external stimuli on growth and movement. *Once a week; both semesters. One-half to two units.* Professor HOTTES

104. MYCOLOGY.—Field and laboratory investigation of selected groups of fungi. *Once a week; both semesters. One-half to two units.* Professor STEVENS

106. PLANT PATHOLOGY.—Diseases of plants, and disease agents. *Once a week; both semesters. One-half to two units.* Professor STEVENS

107. HISTORY OF BOTANY. A conference course with reading and lectures. *Once a week; first semester.* Professor TRELEASE

108. TAXONOMY.—Monographic studies of critical groups. *Once a week; both semesters. One-half to two units.* Professor TRELEASE

109. ECOLOGY.—The interrelation of plants and their environment. *Once a week; both semesters. One-half to two units.* Assistant Professor MCDOUGALL

Courses for Graduates and Advanced Undergraduates

7b. METHODS IN THE STUDY OF FUNGI.—Isolation, cultivation, and inoculation of fungi and bacteria. *Once a week; second semester.* Professor STEVENS

9a-9b. PLANT ANATOMY OR PHYSIOLOGY.—Problems to meet the needs of individual students. *Once a week; both semesters.* Professor HOTTES

10a-10b. CURRENT BOTANICAL LITERATURE.—A weekly review covering the field of botany; supplementary to the various seminar conferences. *Once a week; both semesters.* Professor TRELEASE

14a-14b. HEREDITY, VARIATION, EVOLUTION.—Cells and members of plants; adaptations and changes; mechanism of heredity; evolution. *Twice a week; both semesters.* Professor HOTTES

16b. TAXONOMY AND MORPHOLOGY OF ALGAE AND BRYOPHYTES.—Advanced practise on selected groups. *Once a week; second semester.* Dr. HAGUE

17a-17b. TAXONOMY OF CORMOPHYTES.—Advanced practise on selected taxonomic or economic groups. Specialized studies, as of genera or families of Illinois plants. *Once a week; both semesters.* Professor TRELEASE

22a. MORBID HISTOLOGY.—Histology of plant tissues; parasites in condition of disease. *Once a week; first semester.* Professor STEVENS

22b. STUDIES OF SPECIAL GROUPS OF FUNGI OR DISEASES OF SPECIAL CROPS OR GROUPS OF CROPS.—*Once a week; second semester.* Professor STEVENS

25a-25b. PLANT ECOLOGY.—The ecology of plants or of plant communities. *Once a week; both semesters.* Assistant Professor MCDOUGALL

26. TAXONOMY AND ECOLOGY OF HIGHER FUNGI.—Advanced practise on selected groups. *Once a week; first semester.* (Offered for 1918-19, and in alternate years.) Assistant Professor MCDOUGALL

28a-28b. TAXONOMY OF ECONOMIC FUNGI.—Advanced practise on selected groups of parasitic fungi. *Once a week; both semesters.* Professor STEVENS

29a. COMPARATIVE MORPHOLOGY OF PTERIDOPHYTES, BRYOPHYTES AND ANGIOSPERMS.—Character and scope of work on problems of special interest, with repetition of some phases of this work. *Once a week; first semester.* Dr. HAGUE

BUSINESS ORGANIZATION AND OPERATION

Work may be done in the field of business organization and operation for a major or a minor for the M.S. degree, and for a minor for the doctorate. To do major work in this field, the student must have completed an undergraduate curriculum equivalent to that of the college of commerce and business administration. To do minor work, he must have had at least five semester hours' credit in the principles of economics and at least six semester hours in accounting and business law, respectively.

Courses for Graduates

101. Regulation and Control of Mercantile Distribution.—Federal, state, and local regulation of mercantile business; unfair competition; trade agreements; trade marks; inspection of mercantile establishments; pure food acts; control over weights and measures, packing, storage, and shipment. *Twice a week; both semesters. One unit.* (Not given, 1919-20.)

102. Scientific Management.—The history of the scientific management movement; critical study of the proposed systems. *Twice a week; both semesters. One unit.* (Not given, 1919-20.)

Course for Graduates and Advanced Undergraduates

4. Industrial Organization and Management.—Problems of organization and of administrative policy; supervision and management of industries and industrial units, etc. *Twice a week; second semester.* (Not given, 1919-20.)

CERAMIC ENGINEERING

Graduate work leading to degrees in either ceramic chemistry or ceramic engineering is offered by the department. Graduate students who wish to elect ceramic chemistry as their major field of study must have had the equivalent of twenty-five semester hours in chemistry and this must include satisfactory courses in general chemistry, qualitative and quantitative analysis, and either physical or organic chemistry. Such students must also have had at least one year of college physics and a training in mathematics which includes the calculus.

Candidates for the degree of Doctor of Philosophy in ceramic chemistry must fulfill the same general requirements in chemistry as candidates in other branches of chemistry. They must also offer physical chemistry as one of their minor subjects.

Courses for Graduates

101. The Chemistry of the Compounds of Silicon.—*Twice a week; both semesters. Three-fourths unit.* Professor Washburn

103. Silicon Chemistry.—Laboratory to supplement course 101, which must precede or accompany it. *One to two units. Second semester.* Professor Washburn

102. General Technology of the Clay Industries.—Physical properties of ceramic materials and products; dependence on chemical composition, min-

eralogical constitution, and physical condition. *One to two units. Both semesters.*

Professor PARMELEE

104. TECHNOLOGY OF GLASS.—Glassy silicates; limiting composition; physical and chemical properties of glasses and the dependence of these properties on composition. Lectures and laboratory. *One to two units.*

Professor PARMELEE

Courses for Graduates and Advanced Undergraduates

4. DRYING AND BURNING.—Chemical and physical processes; types of equipment. *Four times a week; first semester.* Assistant Professor HURSH

5. CERAMIC BODIES.—Composition and properties of ceramic body mixtures; effects of various ingredients; development of special bodies. *Daily; second semester.*

Professor PARMELEE

6. GLAZES.—Classes of glazes and enamels; composition, limits, properties and defects. *Daily; first semester.* Professor PARMELEE

8. GLASS.—Raw materials, preparation, compounding, melting, and shaping; chemical principles in the manufacture and decoration of vitreous silicates. *Twice a week; second semester.* Professor PARMELEE

9. CERAMIC CONSTRUCTION.—Plans, specifications, and estimates for ceramic equipments and industrial plants. *Four times a week; second semester.*

Assistant Professor HURSH

10. CEMENTS.—Cements, limes, plasters; composition; reactions; manufacture and testing. *Three times a week; first semester.*

Assistant Professor HURSH

13. CEMENT LABORATORY.—Silicate cements. *Three times a week; second semester.*

Assistant Professor HURSH

14. CEMENT LABORATORY.—Lime and gypsum products; magnesia and other special cementing materials. *Three times a week; second semester.*

Assistant Professor HURSH

15. GLASS LABORATORY.—Soda-lime, potash-lime, lead, barium, and zinc silicates; boro-silicates; fused and solidified glasses; problems. *Three times a week; second semester.*

Professor WASHBURN

16. GLASSES AND ENAMELS.—(Continuation of Ceramic Engineering 15.) Opaque, colored, and optical glasses; the enameling of metals. *Three times a week; second semester.*

Professor PARMELEE

17. THE PRINCIPLES OF PHYSICAL CHEMISTRY WITH SPECIAL REFERENCE TO THEIR APPLICATIONS TO CERAMIC MATERIALS AND PROCESS.—*Three times a week; first semester.*

Professor WASHBURN

18. CERAMIC MICROSCOPY.—The use of the microscope in the examination of ceramic materials and products. *Three times a week; first semester.* (Not given, 1919-20.)

20. REFRACTORY MATERIALS.—Properties and uses of refractory materials employed in the industries; relation between refractory power, chemical composition and physical condition; changes undergone by refractory materials at high temperatures. The subject will be presented as far as possible from the standpoint of the Phase Rule. Lectures and discussions. Assigned reading. *Twice a week; second semester.*

CHEMISTRY

Graduate students who elect chemistry as their major subject of study must have had the equivalent of 25 semester hours in chemistry, including satisfactory courses in general chemistry, qualitative and quantitative analysis, and either physical chemistry or organic chemistry. They must also have had one year of college physics, mathematics through analytical geometry and, if they do not present an acceptable course in physical chemistry, the calculus. The ability to use the calculus is a prerequisite to all courses in physical chemistry.

Before receiving a degree in chemistry the student must have completed work equivalent to courses 31, 33 (or 102 and 102a), 14a, 14b, 9a, 9b. He is advised to take at least brief courses in the history of chemistry, gas analysis, iron and steel analysis, water analysis, assaying, and chemical technology.

For students taking chemistry as a major, courses 14a, b, c, and d, 31, and 33 will be accepted only if on entering the Graduate School they have had the equivalent of 25 semester hours in chemistry.

Graduate students whose major subject is in some other department than chemistry, must have had the equivalent of 15 semester hours in chemistry. The ground covered must include satisfactory work in general chemistry and in qualitative and quantitative analysis. Such students are advised to make selections from the following courses: Chemistry 31, 33, (or 102, 102a), 14a, 14b, 9a, 9b, 15, and 25. Students will not be admitted to courses of a special nature, for graduate credit, unless they have previously taken the appropriate prerequisite courses from the above list.

Courses for Graduates

101. Theories of Chemistry.—Seminar. *Once a week; second semester. One-fourth unit.* Professor Noyes

102. Advanced Physical Chemistry.—(This course with 102a covers a period of two years.) Thermodynamic methods. The first and second laws; the classical analytical method; Nernst heat theorem; energy, entropy, free energy, thermodynamic potential and fugacity; behavior of pure substances, solutions, heterogeneous systems, and chemical equilibria. *Twice a week; both semesters. Three-fourths unit.* (Not given, 1919-20.) Professor Rideal

102a. Advanced Physical Chemistry.—(A continuation of 102.) Kinetic-molecular methods; kinetic theory of gases; entropy and probability; the quantum theory; molecular structure of liquids and solids; electron theory of matter; structure of the atom. *Twice a week; both semesters. Three-fourths unit.* Professor Rideal

102b. Advanced Electrochemistry.—Modern theories of solution; thermodynamics; transformation of chemical and electrical energy. *Three times a week; first semester. One unit.* Professor Rideal

103. Advanced Inorganic Chemistry.—Descriptive inorganic chemistry; the rarer elements; periodic system. *Two to five times a week; both semesters. One-half to one and one-fourth units.* Assistant Professor Hopkins

103a. Advanced Analytical Chemistry.—*One to five times a week; second semester. One-half to one and one-fourth units.*

Assistant Professor Beal

103b. Special Topics in Inorganic Chemistry.—Subject for 1919-1920: The chemistry of the higher order compounds, including the geometric and optical isomerism of inorganic compounds. *Twice a week; first semester. Three-fourths unit.*

103c. Special Topics in Inorganic Chemistry.—Seminar. Rare earths. *Once a week; both semesters. One-fourth unit.* Assistant Professor Hopkins

104. Advanced Organic Chemistry.—Geometric isomerism; optical isomerism; tautomerism; mechanisms of important reactions. *Twice a week; first semester. Three-fourths unit.* Professor Adams

104a. Advanced Organic Chemistry.—Special topics. Carbohydrates; proteins; ureides; alkaloids; terpenes; relationships between chemical constitution and physiological properties; color and constitution; trivalent carbon; bivalent carbon. *Twice a week; second semester. Three-fourths unit.*

Professor Adams

104b. Advanced Quantitative Organic Analysis.—The proteins, alkaloids, glucosides, volatile oils, and other constituents of animal and vegetable tissues. *Twice a week; both semesters. Three-fourths unit.*

Assistant Professor Beal.

104c. Organic Chemistry.—Current literature. Required of all students majoring in organic chemistry. *Once every two weeks; both semesters. One-fourth unit.* Professor Adams, Assistant Professor Kamm

104d. Advanced Organic Chemistry.—The benzene, naphthalene, and anthracene compounds; pyridines; pyrroes. *Twice a week; first semester. Three-fourths unit.* Professor Adams

104e. Advanced Organic Chemistry.—Chiefly laboratory work. The study and development of methods which are suitable for large scale production. (Limited to ten students in 1919-20.) *Both semesters. One unit.*

Professor Adams, Assistant Professor Kamm

105. Advanced Physiological Chemistry.—Structure and distribution of proteins; intermediary metabolism and the glands of internal secretion. *Twice a week; second semester. Three-fourths unit.* Associate Professor Lewis

105a. Advanced Pysiological Chemistry.—Difficult biochemical preparations; the use of the newer analytical methods. *One to five times a week: first or second semester. One-half to one unit.* Associate Professor Lewis

105b-105c. Advanced Physiological Chemistry.—Recent development. *Twice a week; both semesters. One-half unit.* Associate Professor Lewis

106. Animal Chemistry (Animal Nutrition).—*Five times a week; both semesters. One to one and one-half units.* Professor Grindley

107. Special Coal Problems.—Oxygen absorption; storage factors; deterioration and spontaneous combustion; unit coal values; contracts; specifications; inspection. *One to two times a week; first semester. One-fourth to one-half unit.* (Given first semester, 1919, and alternately with 107a.)

Professor Parr

107a. Fuel Technology.—Fuel types: solid, liquid, and gaseous; sources, output, prospective supply, and industrial interrelations; conservation and combustion problems. *One to two times a week; first semester. One-fourth to one-half unit.* (Given first semester, 1918, and alternately with 107.)

Professor Parr

107b. Special Topics in Gas Engineering.—Carbonization processes; by-product constituents and recovery. *One to two times a week; second semester. One-fourth to one-half unit.* Professor Parr

108. Advanced Metallography.—Selected alloy systems; correlation of constitution and properties. *Twice a week; both semesters. Three-fourths unit.* Associate Professor McFarland

109. Advanced Industrial Chemistry.—Chemical industries; development and chemical control of processes. *Twice a week; both semesters. Three-fourths unit.* Associate Professor McFarland

110. Water Supplies.—Sources of contamination of water supplies; purification for potable or technical use. *One to five times a week; both semesters. One-half to one unit.* Professor Bartow.

111. Research.—*Both semesters.*

Physical and Electrochemistry. Professor Rideal
Inorganic Chemistry. Assistant Professor Hopkins, Assistant Professor Beal
Analytical Chemistry. Assistant Professor Beal
Food Chemistry. Assistant Professor Beal
Organic Chemistry. Professors Noyes, Adams, Assistant Professor Kamm and Dr. Rindfusz
Water Chemistry. Professor Bartow
Physiological Chemistry. Associate Professor Lewis
Animal Chemistry (Nutrition). Professor Grindley
Industrial Chemistry. Professor Parr, Associate Professor McFarland
Ceramic Chemistry. Professor Washburn

Courses for Graduates and Advanced Undergraduates

*6. Chemical Technology.—Technological chemistry as illustrated in those industries having a chemical basis for their principal operation and processes. *Three times a week; second semester.*

Associate Professor McFarland

*7. Metallurgy.—General metallurgy; metallurgy of iron and steel. Fulton's *Principles of Metallurgy;* Stoughton's *Iron and Steel. Three times a week; first semester.* Associate Professor McFarland

7a. Metallurgy of the Non-Ferrous Metals.—Copper, lead, zinc, gold, and silver. *Three times a week; second semester.*

Associate Professor McFarland

*Certain required inspection trips will be arranged in connection with courses 6 and 7. Students registering in these courses should take into consideration the expense involved, which will approximate $15.00 for each course.

10a. Study of Water Supplies.—History, sources, contamination, and standards of purity of potable waters and waters for industrial purposes; analytical methods. *Three times a week; second semester.*

Professor Bartow

14a-14b. Organic Chemistry.—Noyes' *Organic Chemistry.* (This course should be accompanied by Chemistry 14c and 14d.) *Four times a week, first semester; twice a week, second semester.* Professor Noyes

14c. Organic Chemistry Laboratory.—Organic synthesis. *Twice a week; first or second semester.* Assistant Professor Kamm, Dr. Rindfusz

14d. Organic Chemistry Laboratory.—Organic synthesis; quantitative and qualitative analysis. (Continuation of 14c, to accompany 14b.) *Twice a week; first or second semester.* Dr. Rindfusz

15. Physiological Chemistry.—*Five times a week; first semester.*

Associate Professor Lewis

15a. Problems of Metabolism.—Intended especially for medical students. *Three times a week; second semester.* Associate Professor Lewis

21. Qualitative Organic Analysis.—Identification of pure organic compounds and mixtures. *Twice a week; first semester.*

Assistant Professor Kamm

25. Food Analysis.—Quantitative organic analysis, with special reference to the examination of food products: alcohols, carbohydrates, fats and oils, cereals, nitrogenous bodies, preservatives, and colors. *Five times a week; first semester.* Assistant Professor Beal

26. Pharmaceutical Chemistry.—The analytical chemistry of medicinal substances, with a discussion of the common types of pharmaceutical preparations. *United States Pharmacopoeia, Ninth Decennial Revision. Three times a week; second semester.* Assistant Professor Beal

27. Qualitative Analysis of the Rare Elements.—*Three times a week; second semester.* Assistant Professor Hopkins

28. Advanced Qualitative Analysis.—Designed especially for those intending to teach qualitative chemistry. *One to three times a week; first semester.* Assistant Professor Hopkins

31. Elementary Physical Chemistry.—Physical chemistry and electrochemistry. *Four times a week; second semester.* Professor Rideal

32. Physical Chemistry.—A continuation of Chemistry 31 including an introduction to thermodynamics as applied to chemistry. Lectures; problems. *Three times a week; first semester.* Professor Rideal

33. Elementary Physical Chemistry.—Molecular weights in gases and in solutions; chemical equilibrium; electrical conductivity of solutions and the phenomena within the solution; thermochemistry. (Laboratory to accompany course 31.) *Twice a week; second semester.* Dr. Dietrichson

35. Electrochemistry.—Electrochemical reactions. Technical applications, including electric furnace processes. *Three times a week; first semester.* Dr. Dietrichson

46. Chemistry of Plant Products.—The occurrence of organic compounds in plants and their relation to plant nutrition. Lectures and laboratory. *Twice a week; second semester.* Dr. Englis

47. Physical Methods in Inorganic Problems.—Selected topics involving the application of the methods of Physical Chemistry. Stewart: *Recent Advances in Physical and Inorganic Chemistry.* (Third Edition). Recitations; assigned readings. *Twice a week; first semester.*
Assistant Professor Reedy

61. Industrial Chemistry Laboratory.—The preparation and purification of chemical products from raw materials on a scale sufficient to afford data for determining the economy of the processes employed. (This course should be accompanied by either 6 or 109.) *Three times a week; second semester.* Associate Professor McFarland

65. Fuels and Flue Gases.—Fuel inspection; gas analysis; determination of calorific values; calculation of efficiencies. *Three times a week; first semester.* Professor Parr

66. Gas Engineering.—Gas machinery; ovens and appliances for carbonization; recovery of by-products. *Once a week; second semester.*
Professor Parr

66a. Control Processes in Gas Manufacture.—Standardization methods; gas yield; inspection of by-product. *Once a week; second semester.*
Professor Parr

69. Metallurgical Laboratory and Assaying.—The fire assay of gold, silver, lead, and copper ores, mattes, and bullion. *Twice a week; first semester.* Associate Professor McFarland

72. Paints, Oils, Turpentines, Varnishes, and Protective Coverings for Wood and Metals.—*Twice a week; first semester.* Professor Parr

76. Chemistry of Oils.—Fractionation; analysis; evaluation for fuel; gas manufacture; lubrication. *Twice a week; second semester.* (Given in 1918 and in alternate years.) Professor Parr

77. Composition and Classification of Coal.—Classification; changes in composition; formation of mine gases. *Once a week; second semester.*
Professor Parr

78. Metallography.—Constitution and microstructure of metals and alloys; properties, chemical and mechanical treatment, and structure. *Twice a week; second semester.* Associate Professor McFarland

95. History of Chemistry.—*Twice a week; first semester.*

Besides the formal courses outlined above, regular scientific meetings are held by the colloquiums of industrial, physical, inorganic, physiological, and organic chemistry; by the Chemical Club; by Phi Lambda Upsilon, and by the University of Illinois Section of the American Chemical Society.

CIVIL ENGINEERING

The prerequisite for graduate work in civil engineering is the equivalent of the undergraduate course required for the degree of Bachelor of Science in civil engineering in the branches of the subject in which registration is desired.

*Courses for Graduates**

101. IRRIGATION AND DRAINAGE.—Survey, examination, construction, maintenance, and operation of works for irrigation and drainage of agricultural lands: the rights to the use of water. *Twice a week; both semesters. Half unit.* Professor NEWELL

103. HIGHWAY CONSTRUCTION.—Machinery and methods of handling materials. Contractor's organization and official control. *Twice a week; both semesters. One unit.* Professor BAKER

106. REINFORCED CONCRETE DESIGN.—Elastic theory. *Twice a week; both semesters. One to two units.* Professor ELLIS

107. BRIDGE ENGINEERING.—Deflections; the statically indeterminate frame; swing bridges and arches; special graphical methods; suspension bridges; secondary stresses; impact. *Twice a week; both semesters. One to two units.* Professor ELLIS

124. STEEL BUILDING CONSTRUCTION.—Steel framing of fireproof office, industrial, and hotel buildings; wind bracing; long columns; eccentrically loaded columns; eccentric connection; analysis of special details. *Twice a week; both semesters. One to two units.* Professor ELLIS

THE CLASSICS

The Degree of Master of Arts in the Classics.—The major may be either Latin or Greek.

Before the period of the regular course examinations of the second semester, each candidate must also pass two examinations which are to be regarded as tests of attainment rather than as a requirement of special or additional preparation. The first examination consists of written translation at sight, from the candidate's major language, or passages equivalent in difficulty to the work of first-year graduate courses. The second examination is oral and designed to determine the candidate's general ability and his advancement in the various fields of classical philology, especially those treated in course 110, Bibliography and Criticism.

The Degree of Doctor of Philosophy in the Classics.—The degree is given in classical philology. Major work may be taken in either Latin or Greek, but whichever language is taken as a major, the other must be taken as the first minor.

GREEK

Preparation for first-year graduate work in Greek must include at least two years of preparatory Greek, two years of college Greek, and two years of college Latin. A reading knowledge of French or German, preferably the latter, is highly desirable for candidates in this subject. The study of history and philosophy is especially recommended.

*Courses offered to Junior and Senior students are open for minor credit to students majoring in other fields.

Courses for Graduates

104. Homer and the Homeric Question.—*Twice a week; both semesters. One unit.* (Not given, 1919-20. Alternates with 105.)
Professor Oldfather

105. Plato and Aristotle.—*Twice a week; both semesters. One unit.*
Professor Oldfather

106. Greek Drama.—*Twice a week; both semesters. One unit.*
Professor Pease

107. Greek Oratory.—*Twice a week; both semesters. One unit.* (Not given, 1919-20.)

Courses for Graduates and Advanced Undergraduates

(For minor credit only)

5. Herodotus; The Lyric Poets.—Selections. *Three times a week; first semester.* Professor Pease

6. Thucydides.—Books VI-VII. *Three times a week; first semester.* (Not given, 1919-20. Alternates with 5.) Professor Pease

7. The Drama.—*Three times a week; second semester.* (Not given, 1919-20. Alternates with 8.) Professor Pease

8. Plato.—Selected Dialogues, including Phaedo; the Apology. *Three times a week; second semester.* Professor Pease

14. Greek Prose Composition.—*Once a week; second semester.* (Not given, 1919-20.)

21. See Latin 21.

Latin

Preparation for first-year graduate work in Latin must include at least two years of preparatory Latin, and four years of college Latin, or three years of preparatory Latin and three years of college Latin. A reading knowledge of French or German, preferably the latter, is highly desirable. Some acquaintance with Greek is indispensable, and the study of history and philosophy is especially recommended.

Courses for Graduates

102. Roman Oratory.—*Twice a week; first semester. One unit.*
Associate Professor Canter

103. Cicero.—The De Natura Deorum and the De Divinatione. The Epicurean, Stoic, and Academic theories of religion and their relation to the popular worship. *Twice a week; second semester. One unit.* Professor Pease

104. Latin Palaeography.—Material and form of ancient books; methods of copying; common errors in manuscripts; facsimiles of codices; text criticism. *Twice a week; first semester. One unit.* Professor Pease

106. Terence.—*Twice a week; first semester. One unit.* (Not given, 1919-20.) Professor Oldfather

107. Latin Epigraphy.—Forms and language of inscriptions; selections from the Corpus Inscriptionum Latinarum. *Twice a week; second semester. One-half to one unit.* (Not given, 1919-20. Alternates with 104.)
Professor Pease

108. Tacitus.—The Histories. *Twice a week; second semester. One unit.* Professor Barton

109. Virgil.—*Twice a week; first semester. One unit.* Professor Pease

110. Thesis Course: Bibliography and Criticism.—All graduate students who are taking Latin or Greek as a major for the master's degree must take this course. *Once a week; both semesters. One unit.*
Professors Oldfather, Pease, and others

Attention is also called to Comparative Philology 101—Comparative Philology of the Indo-European Languages.

112. Roman Historiography.—*Twice a week; first semester. One unit.* (Not given, 1919-20.) Associate Professor Canter

113. Plautus.—*Twice a week; first semester. One unit.* (Not given, 1919-20.) Professor Oldfather

114. Caesar.—Historical works especially the Bellum Gallicum. *Twice a week; second semester. One unit.* Professor Oldfather

115. Roman Elegy.—Relation to other lyric forms; translations from Catullus, Tibullus, and Propertius. *Twice a week; second semester. One unit.* (Not given, 1919-20.) Associate Professor Canter

Courses for Graduates and Advanced Undergraduates

7. Satire.—Selected Satires and Epistles of Horace and Selected Satires of Juvenal. *Three times a week; first semester.* (Not given, 1919-20. Alternates with 8.) Professor Pease

8. Tacitus.—The Annals, books I-VI. *Three times a week; first semester.* Professor Pease

14. Seneca.—Letters and tragedies. *Three times a week; second semester.* (Not given, 1919-20. Alternates with 16.) Professor Barton

16. Martial and Suetonius.—*Three times a week; second semester.*
Professor Oldfather

21. Special Topics in the History of Greece and Rome.—*Twice a week; second semester.* (Not given, 1919-20.) Professor Oldfather

22. Late Latin.—Rapid reading of selections from Latin Christian writers from Minicius Felix to Cassiodorus. *Twice a week; second semester.* (Not given 1919-20.) Professor Pease

COMPARATIVE PHILOLOGY

Course for Graduates

101. Comparative Philology of the Indo-European Languages.—Greek, Latin, and the Germanic languages, including English. *Second semester; twice a week.* Assistant Professor Bloomfield

Courses for Graduates and Advanced Undergraduates

1. INTRODUCTION TO THE STUDY OF LANGUAGE.—Phonetics; the development of forms of speech; dialects and the spread of languages; the study and teaching of languages. *First semester; three times a week.*
Assistant Professor BLOOMFIELD

3. ELEMENTARY SANSKRIT.—*First semester; three times a week.*
Assistant Professor BLOOMFIELD

4. ELEMENTARY SANSKRIT.—(Continuation of 3.) *Second semester; three times a week.* Assistant Professor BLOOMFIELD

DAIRY HUSBANDRY

Candidates for the master's degree may take their major work in dairy husbandry, preparing a thesis in the field of dairy bacteriology, dairy chemistry, or milk production. Such students must have had at least 10 semester hours of previous work in dairy husbandry, including adequate preparation for the desired graduate courses.

Candidates for the master's degree desiring a minor in dairy husbandry must have had the introductory work regularly required to enter the desired course or courses.

Candidates who desire to register for a doctorate with their major interest in dairy bacteriology as well as those who desire to take dairy bacteriology as a part of a minor for the doctorate should register in bacteriology according to the regulations given under bacteriology on page 29.

Courses for Graduates

101. ECONOMIC MILK PRODUCTIONS.—Efficiency of dairy farms; factors influencing profits. *Twice a week; both semesters. One or two units.*
Professor FRASER

104. SCIENTIFIC READINGS.—Discussion of bacteriological problems based on selected German or French texts. (Recommended for first and second year students.) *Once a week; both semesters. One-half unit.*
Professor HARDING, Associate Professor PRUCHA

105. BACTERIOLOGICAL LITERATURE.—Each student is required to prepare and deliver an acceptable course of lectures. (Recommended for second-year and third-year men). *Once a week or once in two weeks; both semesters. One-half or one unit.* Professor HARDING

106. RESEARCH ON ASSIGNED PROBLEMS.—(Open to graduate students whose development permits their undertaking problems of dairy bacteriology with only general supervision.) *Both semesters. One-half unit to two units.*
Professor HARDING, Associate Professor PRUCHA

107. DAIRY CHEMISTRY.—Assigned problems. *Once a week; both semesters. One unit.* Assistant Professor OVERMAN

Courses for Graduates and Advanced Undergraduates

10. DAIRY BACTERIOLOGY.—Study of some of the more important relations of bacteria to milk and its products. Lectures; laboratory. *Three times a week; second semester.* Professor HARDING

11. Dairy Bacteriology.—Bacteria in milk and its products; sources, effect on milk, and method of control. *Twice a week; first semester.* (Not given, 1919-20.) Professor Harding

12a-12b. Dairy Bacteriology.—Laboratory work supplementing Dairy Husbandry 11. *Four times a week; both semesters.* (Not given, 1919-20.) Professor Harding

20. Economic Problems in Dairy Farming.—*Three times a week; first semester.* Professor Fraser

21. Economic Milk Production.—*Five times a week; second semester.* Professor Fraser

ECONOMICS

Every student entering on major graduate work in economics must have had a course in the principles of the science and also in some special part of the field such as public finance or money and banking. The work must represent at least eight semester hours. He must also have had at least one semester's work in English, American, or general European history; and at least three hours in political science.

Those who take the subject as a minor must have had a course of at least five semester hours in the principles.

Graduate students who are making economics their major are required during their first year to acquaint themselves with the works of the masters in the science, either by taking course 101 or by private reading for examination. In the second or third year they are expected to elect courses 105 and 120, and some fundamental course in political science and sociology unless they have already had such courses.

The following courses may be taken by students in general economics for major or minor credit: all numbered above 100; 4, 5, 10, 12, 13, 19, 20, 21, 29, 61. The following may be taken for minor credit only: 8, 9, 14, 15, 17, 28, 31.

Two units will be accepted for a first minor for the master's degree; and four two or three hour graduate courses, or their equivalent in advanced undergraduate courses, for a first minor for the doctor's degree.

Courses in transportation may be included in their programs by students of economics as part of either their major or minor subjects. See Transportation.

Courses for Graduates

101. Economic Theory.—*Twice a week; both semesters. One unit.* Professor Weston

104. Foreign Commerce.—*Twice a week; both semesters. One unit.* Professor Litman

105. Public Finance.—*Twice a week; both semesters. One unit.* (Not given, 1919-20.) Professor Bogart

107. The Corporation in Economic Evolution.—*Twice a week; both semesters. One unit.* (Not given, 1919-20.) Professor Robinson

109. THEORY OF INDUSTRIAL CONSOLIDATION.—The nature, causes, and effects of industrial consolidation; prices, profits, and wages. *Twice a week; both semesters. One unit.* (Not given, 1919-20.) Professor ROBINSON

110. INVESTMENTS.—Nature, character, and function of investments; classes including direct investment and securities of various types; methods of judging investments; state control. *Twice a week; both semesters. One unit.* Professor ROBINSON

118. SEMINAR.—Bi-weekly discussion of the results of students' investigations. Members of the staff

122. ADVANCED ECONOMIC HISTORY OF THE UNITED STATES.—*Twice a week; both semesters. One unit.* (Not given, 1919-20. See Economics 19 and 20.) Professor BOGART

THEORY OF STATISTICS. See Mathematics 129.

Courses for Graduates and Advanced Undergraduates

4. FINANCIAL HISTORY OF THE UNITED STATES.—*Three times a week; second semester.* Assistant Professor HUNTER

5. PUBLIC FINANCE.—Public debts, revenue, taxation, etc. *Three times a week; first semester.* Assistant Professor HUNTER

8. THE MONEY MARKET.—*Twice a week; second semester.* Professor WESTON

9. PRACTICAL BANKING.—*Twice a week; first semester.* Professor WESTON

10. CORPORATION MANAGEMENT AND FINANCE.—*Three times a week; second semester.* Professor ROBINSON

11. INDUSTRIAL CONSOLIDATION.—Development; plans for controlling trusts. *Three times a week; first semester.* Professor ROBINSON

12. LABOR PROBLEMS.—*Three times a week; both semesters.* Assistant Professor WATKINS

13. ECONOMIC DEVELOPMENT OF EUROPE SINCE THE INDUSTRIAL REVOLUTION.—*Three times a week; second semester.* (Not given, 1919-20.) Professor BOGART

14. AGRICULTURAL CO-OPERATION. *Twice a week; second semester.* (Not given, 1919-20.)

15. RURAL CREDIT.—*Twice a week; first semester.* (Not given, 1919-20.)

17. ECONOMIC HISTORY OF AGRICULTURE.—*Twice a week; second semester.* (Not given, 1919-20.)

19. ECONOMIC HISTORY OF THE UNITED STATES, 1820-1860.—*Twice a week; first semester.* Professor THOMPSON

20. ECONOMIC HISTORY OF THE UNITED STATES SINCE 1860.—*Twice a week; second semester.* Professor THOMPSON

21. SOCIALISM AND ECONOMIC REFORM.—*Twice a week; second semester.* Assistant Professor WATKINS

28. Mechanism and Technic of Domestic Commerce.—*Three times a week; first semester.* Professor Litman

29. International Trade and Trade Policies.—*Twice a week; second semester.* Professor Litman

31. Organization of Foreign Commerce.—Exporting and importing; means of communication and of transportation; the shipping business; duties of consuls. *Three times a week; second semester.* Professor Litman

61. Economic Theory.—*Twice a week; both semesters.* Professor Thompson

EDUCATION

Students who elect education as a major subject must have completed at least a three-hour course in the principles of education, a course of at least the same length in the history of education, and a minimum of three hours each in psychology and philosophy. For graduate students who have had experience in teaching, these requirements may be modified.

Courses for Graduates

101. Seminar in Educational Theory.—*Once a week, two hours; first semester. One unit.* Professor Bode

102. Seminar in History of American Education.—*Once a week, two hours; second semester. One unit.* Associate Professor Seybolt

104. Seminar in Educational Administration.—*Once a week; second semester. One unit.* Dean Chadsey

110. Seminar in Methods of Teaching.—Individual investigation of problems of technic. *Once a week, two hours; first semester. One unit.* (Not given, 1919-20.)

119. Curriculum Construction.—*Once a week, two hours; first and second semester. One unit each semester.* (Not given, 1919-20.)

121. Seminar in Educational Measurements.—*Once a week, two hours; second semester. One unit.* Associate Professor Monroe

125. Seminar in Educational Psychology.—Psychology of school subjects. *Once a week, two hours; first semester. One unit.* Professor Cameron

Departmental Conference.—Every alternate Monday from 7 to 9 p. m. All graduate students majoring in education are expected to meet with the departmental staff at this time. The work carries no credit. *First and second semesters.*

Courses for Graduates and Advanced Undergraduates

4. Problems of Educational Administration.—Interpretation of present tendencies. *Three times a week; first semester.* Dean Chadsey

5. Comparative Education.—Organization, administration and basic national ideals of the school systems of the United States, Germany, England, Denmark, Norway, Sweden, Holland, Japan and France, with reference to secondary education and to the training of teachers. *Three times a week; second semester.* Dean Chadsey

6. PRINCIPLES OF SECONDARY EDUCATION.—*Three times a week; second semester.* Assistant Professor BELTING

10. THE TECHNIC OF TEACHING.—*Three times a week; first and second semesters.* Assistant Professor BELTING, Mr. CAPPS

16. EDUCATIONAL FINANCE.—*Three times a week; second semester.* Professor BUCKINGHAM

17. EDUCATION.—The Teacher. Preparation, selection, placement agencies, requirements for certification, salary, pensions, methods of promotion in service, professional ethics. Lectures, reading, and discussions. *Twice a week; first and second semesters.* Mr. WILLIAMS

18. THEORY OF EDUCATIONAL MEASUREMENTS.—*Three times a week; first semester.* Associate Professor MONROE

19. READINGS IN FRENCH AND GERMAN EDUCATIONAL LITERATURE.—*Twice a week; second semester.* Associate Professor SEYBOLT

20a. THEORY OF SUPERVISION.—*Three times a week; first semester.* Mr. CAPPS

21. UNITS, SCALES AND STANDARDS.—*Three times a week; second semester.* Associate Professor MONROE

23. EDUCATIONAL STATISTICS.—*Three times a week; first semester.* Professor BUCKINGHAM

25. EDUCATIONAL PSYCHOLOGY.—*Three times a week; first semester.* Professor CAMERON

27. HIGH SCHOOL CURRICULUMS.—*Three times a week; second semester.* Assistant Professor BELTING

28. THE PROJECT METHOD OF TEACHING.—A course for superintendents, principals, supervisors, and teachers. A study of the current literature. The relation of the project to curriculum organization, thinking, motivation. Application of the project method. Lectures, readings, and investigation of special problems. *Twice a week; first or second semesters.* Mr. CAPPS

42. AUXILIARY EDUCATION.—The institutions and methods for the training of defectives and delinquents; the Binet-Simon tests and other methods of mental diagnosis; educational treatment of morons and of moral delinquents; methods of teaching sensory defectives (the blind and the deaf); public institutions of auxiliary education and their administration. *Twice a week; second semester.* Professor CAMERON

43. MENTAL TESTS.—Laboratory drill; tests of sensory capacities; attention; memory; learning; suggestibility; inventiveness; system of tests for diagnosis of mental age, general intellectual status; mental retardation. *Twice a week; second semester.* Professor CAMERON

45. PROBLEMS IN EDUCATIONAL PSYCHOLOGY.—*Time to be arranged. Either semester.* Professor CAMERON

50. TEACHING.—*Five times a week; first and second semesters.* Mr. COLVIN, Mr. REID

51. TEACHERS' COURSE IN AGRICULTURE.—Principles and methods in secondary school agriculture. *Three times a week; first and second semesters.* Mr. COLVIN, Mr. REID

ELECTRICAL ENGINEERING

The prerequisite for graduate work in electrical engineering is the equivalent of the undergraduate courses required for the degree of Bachelor of Science in electrical engineering in the branches of the subject in which registration is desired.

Graduate students who wish to take a minor in electrical engineering must have had differential and integral calculus, and one year's work in college physics.

*Courses for Graduates**

101. Advanced Course in Alternating Currents.—The theory of transient phenomena; polyphase circuits; measuring apparatus. *Twice a week; both semesters. One and one-half units.* Professor Paine

103. Electrical Designs.—Plans for an electrical machine or apparatus of specified character; or for the arrangement of an electrical plant; or for the installation of such machinery or apparatus. *Twice a week; second semester. One unit.* Assistant Professor Waldo

105. Electrical Engineering Research.—Investigation of electrical phenomena, or test of some electrical machine or apparatus. *Twice a week; both semesters. One to three units.* Professor Paine, Professor Brooks

ENGLISH LANGUAGE AND LITERATURE

Students who enter on graduate work with English as their major subject are required to give evidence of their ability to write good English. They must present the equivalent of fourteen hours of undergraduate work in English literature, the required college work in rhetoric, and the equivalent of four semesters of college work in a language other than English. After the first year of graduate work a knowledge of French and German is indispensable.

Students making English their minor may be admitted to such courses as in the judgment of the instructor in charge they are qualified to pursue.

The Degree of Master of Arts in English.—In addition to complying with the general rules of the Graduate School, candidates for the degree of Master of Arts in English must comply with the following rules of the Department of English: (1) they must choose a portion of their work from the group of courses described as "for graduates"; (2) must offer an elementary course in Anglo-Saxon; and (3) must take, besides the regular semester examinations in all their courses, a general examination, oral or written as the department may prescribe, which shall be a final test of the candidate's fitness and ability.

The Degree of Doctor of Philosophy in English.—Candidates for the degree of Doctor of Philosophy in English may expect to be examined on the entire field of the English language and literature. They are urged, furthermore, to acquaint themselves as fully as possible with the history and philosophy of the period in which their main interest lies, and with the foreign languages and literatures most closely related to English in that period.

*Courses offered to Junior and Senior students are open for minor credit to students majoring in other fields.

Courses for Graduates

101. Research in Special Topics.—Guidance in writing theses for advanced degrees. *From one to two units.* Professor Sherman, Professor Dodge, Professor Bernbaum, Associate Professor Paul, Assistant Professor Baldwin, Assistant Professor Scott, Assistant Professor Jones, Assistant Professor Zeitlin

110. Old English (Anglo-Saxon) Poetry.—*Twice a week; first semester. One unit.* Professor Dodge

112. The History of the English Language.—*Twice a week; both semesters. One unit.* (Not given, 1919-20.) Assistant Professor Zeitlin

114. The Development of the Essay.—The English essay; continental influences; classical origins. *Twice a week; both semesters. One unit.* Assistant Professor Zeitlin

120. The History of English Criticism.—Critical standards from Aristotle to Sainte-Beuve. The main types of criticism. *Twice a week; both semesters. One unit.*

126. Ballads.—Studies in the relation of folk poetry to literature. *Twice a week; first semester. One unit.* (Not given, 1919-20.)

127. Metrical Romances.—The beginnings of verse fiction. *Twice a week; second semester. One unit.* (Not given, 1919-20.)

128. Spenser and the Beginnings of the English Renaissance.—The persistence of certain medieval traditions reinforced by the Revival of Classical Learning; Catholicism and Calvinism as sources of literary inspiration. *Twice a week; both semesters. One unit.* Assistant Professor Jones

129. English Literature from Norman Conquest to Chaucer.—Middle English authors exclusive of Chaucer. *Twice a week; both semesters. One unit.* (Not given, 1919-20.) Assistant Professor Jones

135. Problems in American Literature.—Poe, Lowell. *Twice a week; both semesters. One unit.* (Not given, 1919-20.) Associate Professor Paul

136. The Transition from the Seventeenth to the Eighteenth Century, 1675-1725; the Rise of Classicism.—*Twice a week; both semesters. One unit.* Associate Professor Paul

137. Prose Writers of the Nineteenth Century.—Relation of literature to social forces; Mill, Carlyle, Newman, Ruskin, Arnold, and Pater. *Twice a week; both semesters. One unit.* Professor Sherman

138. The Romantic Movement in England.—*Twice a week; both semesters. One unit.* (Not given, 1919-20.) Professor Sherman

139. The Sonnet Revival in the Eighteenth Century.—Special topics for investigation and report, with emphasis on methods of research. *Twice a week; first semester.* Dr. Rinaker

140. Investigations in Modern English Literature.—(For second-year and third-year graduate students who are preparing theses for the doctor's degree.) *Three hours once a week; both semesters. One to three units.* (May be taken in successive years.) Professor Bernbaum

141. THE HISTORY OF SEVENTEENTH CENTURY ENGLISH LITERATURE TO ABOUT THE YEAR 1675.—Poetry, beginning with Shakespere's Sonnets. *Twice a week; both semesters. One unit.* (The first semester may not be taken separately.) Professor BERNBAUM.

142. THE CONFLICT OF IDEAS AND IDEALS IN EIGHTEENTH CENTURY LITERATURE.—*Twice a week; both semesters. One unit.* (Not given, 1919-20.) Professor BERNBAUM

143. THE ORIGINS OF THE ENGLISH NOVEL, AND ITS HISTORY TO THE END OF THE EIGHTEENTH CENTURY.—*Twice a week; both semesters. One unit.* (The first semester may not be taken separately.) Professor BERNBAUM

144. LINCOLN'S LETTERS AND SPEECHES.—Development of style, relation to period, textual study, contemporary estimates. *Twice a week; second semester. One unit.* Professor DODGE

Courses for Graduates and Advanced Undergraduates

A. ENGLISH LITERATURE AND LANGUAGE

3. THE POETRY OF MILTON.—Origins, forms, artistic and ethical values; Milton's place in English literary history. *Three times a week; second semester.* Assistant Professor BALDWIN

4. ENGLISH VERSIFICATION.—Verse forms; reading of representative poems. Verse composition; individual conferences. *Three times a week; first semester.* Dr. CREEK

5. SHAKSPEARE.—Six plays, with special emphasis on *Hamlet. Three times a week; second semester.* Professor DODGE

8-9. OLD ENGLISH (ANGLO-SAXON).—Grammar; prose; short poems; *Beowulf.* (The first semester may be taken separately.) *Three times a week; both semesters.* Professor DODGE

17. THE ENGLISH LANGUAGE.—History, characteristics, and usage of modern English. *Three times a week; first semester.* Assistant Professor ZEITLIN

18. MODERN ENGLISH GRAMMAR.—Sentence structure and analysis; grammatical categories; peculiarities of English syntax. *Three times a week; second semester.* (Not given, 1919-20.) Assistant Professor ZEITLIN

25. CHAUCER.—*Three times a week; first semester.* Assistant Professor JONES

27-28. STUDIES IN THE RELATIONS OF JOURNALISM AND LITERATURE.—*First semester*: English Literary Periodicals and the genesis and evolution of the Periodical essay in the 17th and 18th Centuries. *Second semester*: The Magazine in America. *Twice a week; both semesters.* Assistant Professor SCOTT

35. THE ENGLISH DRAMA FROM THE BEGINNING TO 1600 [*Exclusive of Shakespeare*].—The Religious Drama, Morality Plays, Sackville, Udall, Lyly, Peele, Greene, Kyd, Marlowe, etc. *Three times a week; first semester.* Professor DODGE

36. THE ENGLISH DRAMA FROM 1600 TO 1700 [*Exclusive of Shakespeare*].—Jonson, Chapman, Dekker, Marston, Heywood, Middleton, Beaumont and

Fletcher, Webster, Ford, Massmyer, Dryden, Wycherley, Vanbrugh, Congreve, etc. *Three times a week; second semester.* Dr. HILLEBRAND

38. THE ARTHURIAN TRADITION.—The historical Arthur; Celtic influences; Old French Romances (in translation); the tradition in England to the present time, with especial attention to Malory and Tennyson. *Twice a week; second semester.* (Not given, 1919-20.)

39. INTRODUCTION TO THE LITERATURE OF THE MIDDLE AGES.—Classical influences. Principal types: epic, romance, legend, lay, allegory, fabliau, lyric. Important poems, both English and continental, will be read in translation. *Three times a week; second semester.* Dr. CREEK

45. THE DEVELOPMENT OF THE MODERN DRAMA.—Dramatic tendencies in the Nineteenth century, both in England and on the Continent. *Three times a week; first semester.* Dr. HILLEBRAND

49. LITERARY TREATMENT OF ECONOMIC AND SOCIAL PROBLEMS, 1770-1870. —*Three times a week; second semester.* Dr. BOYER

52. THE GREAT NOVELISTS OF THE NINETEENTH CENTURY.—Scott, Jane Austen, Dickens, Thackery, Hawthorne, George Eliot, Meredith, Hardy, Stevenson. *Three times a week; second semester.* Professor BERNBAUM

53. MATTHEW ARNOLD.—His prose and poetry with special reference to the main currents of nineteenth century thought. *Three times a week; second semester.* Professor SHERMAN

54. INTRODUCTORY AND COMPARATIVE SURVEY OF THE GREATEST GREEK, LATIN, ITALIAN, SPANISH, FRENCH, GERMAN, AND ENGLISH AUTHORS.—*Three times a week; both semesters.* Professors OLDFATHER, OLIVER, FITZ-GERALD, LESSING, and BERNBAUM, and Dr. VAN HORNE.

The second semester may not be taken separately.

The assigned reading may be done in translations.

60a-60b. THESIS.—Special training in investigation for candidates for honors and for other seniors. *Once a week; both semesters.*

Assistant Professor ZEITLIN, and others

B. RHETORIC

17. ADVANCED COMPOSITION.—Practise writing, with special emphasis on structure; criticism of current periodical literature; development of material for reports, magazine articles, etc. (Open to a limited number of students, and only on recommendation.) *Three times a week; second semester.*

Dr. BOYER

C. THE SCANDINAVIAN LANGUAGES

Preparation for major graduate work in the Scandinavian languages or literature must include a good knowledge of one of the Scandinavian languages and systematic work in the undergraduate courses in Scandinavian. Any graduate student in language may, however, be admitted to the purely philological courses.

Courses for Graduates

101. Old Norse.—Introduction to the language. Reading of the *Prose Edda. Twice a week; both semesters. One unit.* Professor Flom

103. Old Swedish.—Noreen's grammar and reader is used. *Twice a week; second semester. One unit.* (Not given, 1919-20.) Professor Flom

110. Advanced Old Norse.—Lays of the *Elder Edda* and selections from the *Speculum Regale* (*Konungs Skuggsja*). *Twice a week; both semesters. One unit.* (Not given, 1919-20.) Professor Flom

140. Early Scandinavian Paleography.—(The work is based on the facsimiles and photographs of manuscripts in the Scandinavian Collection of the University library.) Old English script will also be briefly considered. *Twice a week; second semester. One unit.* (Not given, 1919-20.)
Professor Flom

150. Research.—Special problems in Scandinavian philology or literature. *Once a week; first semester. One-half to two units.* Professor Flom

Courses for Graduates and Advanced Undergraduates

14. History of Old Norse Literature.—The mythical lays, the court poetry, the sages, the ballads. *Twice a week; first semester.*
Professor Flom

16. Introduction to the History of Early Scandinavian Culture.—The civilization of Scandinavia in the Ages of Stone, Bronze and Iron down to the close of the Viking migrations and the introduction of the Latin script. *Twice a week; second semester.* Professor Flom

ENTOMOLOGY

The prerequisite for graduate work in entomology is two years of undergraduate biology, of which one year should be zoology. Entrance on major work in entomology requires Entomology 15 or its equivalent. A reading knowledge of French and German is necessary at least by the beginning of the second year.

Courses for Graduates

102. Research in the Morphology and Embryology of Insects.—*Twice a week; both semesters. One or two units.*
Assistant Professor Folsom

108. Research in Economic Entomology.—*Once or twice a week; both semesters. One or two units.* Assistant Professor Folsom

109. Research in Systematic Entomology.—*Twice a week; both semesters. One or two units.* Professor MacGillivray

Courses for Graduates and Advanced Undergraduates

20. Taxonomy of Immature Insects.—External form of immature insects; identification of species. *Three times a week; both semesters.*
Professor MacGillivray

11. Classification of the Coccidae.—Preparing scale insects for study; identification of genera and species; morphology, metamorphosis, and phylogeny. *Three times a week; second semester.* Professor MacGillivray

15. Introductory Course.—Metamorphosis and development of insects; orders, suborders, and families; habits of species; anatomy of immature and adult insects; special adaptive structures; classification of insects. (Not open to students who have had course 2.) *Three times a week; first semester.* Professor MacGillivray

17. Insect Organogeny.—Adult and immature insects. *Three times a week; both semesters.* Professor MacGillivray

18. Insect Taxonomy.—Structures used in the classification of insects; identification of a representative collection of insects. *Five times a week; both semesters.* Professor MacGillivray

FRENCH

(See Romance Languages)

GENETICS

Instruction in courses leading to advanced degrees in genetics is offered by the departments of agronomy, animal husbandry, botany, horticulture, and zoology. The work is offered under the supervision of a committee representing these departments.

The prerequisites for major work in genetics are Botany 1 and 3a, Mathematics 2 and 4, and Zoology 1 and 2, or their equivalents. A reading knowledge of German and French is indispensable.

The prerequisite for minor work in genetics is 10 hours of botany or zoology.

Courses for Graduates

Agronomy

112. Plant Breeding.—Experiments at this station; methods and results reported from other states and from foreign countries. *Twice a week; both semesters. One to two units.* Professor Smith

Animal Husbandry

117. Genetic Experiments on Animals and Plants.—Biological and mathematical methods employed; the validity of the conclusions. *Two to five times a week; both semesters. One to two units.* Professor Detlefsen

112e. Research.—Experimental investigations in heredity and variation. (This course may be taken during the summer by special permission.) *Once a week; both semesters. One to two units.* Professor Detlefsen

Botany

101. Individual Plant Development.—Origin of the individual; external and internal factors in its development and physiologic performance; response of the cell, somatic and generative, to external factors. *Once a week; both semesters. One to two units.* Professor Hottes

Zoology

115. Factors of Individual and Racial Development.—Experimental embryology; regeneration; heredity; variation; evolution. *Twice a week; both semesters. One unit. Time to be arranged.* Professor Zeleny

124. Experimental Zoology.—Individual research course. *Both semesters. One to two units. Time to be arranged.* Professor Zeleny

Courses for Graduates and Advanced Undergraduates

Agronomy

22. Plant Breeding.—The improvement by breeding of field crops, including grains, grasses, and legumes. With practical application. *Twice a week; second semester.* Professor Smith

Animal Husbandry

30. Genetics.—Heredity, variation, elements of biometry, and their practical application to breeding. *Five times a week; first semester.* Professor Detlefsen

Botany

14a-14b. Heredity, Variation, Evolution.—Cells and members of plants; adaptations and changes; mechanism of heredity; evolution. *Twice a week; both semesters.* Professor Hottes

Horticulture

12. Evolution of Horticulture Plants.—History, botanical classification, and geographical distribution of cultivated plants; modification under culture; variation. *Three times a week; first semester.* Professor Crandall

Zoology

25-26. Experimental Zoology.—Experimental embryology; regeneration; heredity; variation; evolution. *Two to five times a week; both semesters.*

(See also Mathematics 29; Zoology 8, 20.) Professor Zeleny

GEOLOGY

For graduate work in geology the student must have a sound elementary training in the general principles of the science, and must have done advanced work in at least one of its branches. Except in unusual cases, which will be decided on their merits, at least 20 hours of geology and two weeks or more of field experience will be required. Graduate students with adequate technical preparation in other sciences may be admitted to graduate courses in certain subjects, such as crystallography.

Under the present organization of the department, major fields of study for the doctorate will normally be: (a) historical geology, including sedimentation; (b) stratigraphy and paleontology; (c) economic geology, including mineralogy and petrology. First or second minor subjects are available as follows, except that in no case may the minor subject belong to the more com-

prehensive field in which the major is selected: (a) physiography; (b) stratigraphy; (c) paleontology; (d) historical geology; (e) sedimentation; (f) petrology; (g) economic geology; (h) mineralogy and crystallography (limited to students who are not majoring in geology).

A first minor presupposes 4 units, and a second minor 2 units credit.

Courses for Graduates

101. Advanced Crystallography.—The methods used in measuring, projecting, and calculating crystal forms, and determining the physical properties of crystallized bodies. *Twice a week; both semesters. One unit.*

Professor Bayley

102. Igneous Petrography.—The igneous rocks; identification of types, classification, and relationships. *Twice a week; first semester. One unit.*

Professor Bayley

103. Metamorphic Petrography.—Microscopy of the metamorphic rocks; interpretation of their origin. *Twice a week; second semester. One unit.*

Professor Bayley

105. Paleontologic Problems.—Fossil invertebrates by zoological or faunal groups. *One to three times a week; both semesters. One unit.*

Professor Savage

108. Ore Deposition.—Origin of ore deposits, as illustrated by selected mining districts. *Three times a week; both semesters. One unit.*

Professor Bayley

125. Sedimentation.—The interpretation of sedimentary rocks in terms of their origin. *Once a week; both semesters. One unit.*

126. Historical Problems.—*Once a week; both semesters. One unit.*

130. Field Research.—Investigation of the geology or geography of an approved district, under general supervision of a member of the department faculty. Weekly reports. *S. One-half to three units.*

Professor Bayley, Professor Savage

135. Research.—Individual work under the supervision of members of the staff in their respective fields. *Once a week; both semesters and summer. One to four units.* Professor Bayley, Professor Savage

136. Seminar in Physical Geology.—Special problems in mineralogy, petrography, economic geology, metamorphism, and related subjects. *Once a week; both semesters. One unit.* (Not given first semester, 1919-20.)

Professor Bayley

Courses for Graduates and Advanced Undergraduates

6. Optical Mineralogy.—An introduction to the courses in petrography. *Twice a week; first semester.* Professor Bayley

7. Petrography.—The prinicples learned in course 6 are applied to the study of rocks. *Once a week; second semester.* Professor Bayley

15. Structural Geology.—*Three times a week; first semester.*

23. Physiography of the Lands.—The making of topographic features as controlled by such factors as climate, and rock structure. Physiographic history. Two Saturday field trips. *Twice a week; second semester.*

24. Physiographic Interpretations.—The application of physiographic principles to the interpretation of recent earth history. *Twice a week; first semester.*

31. Geology of Oil and Gas.—Origin and relations of the natural hydrocarbons; their distribution both geographically and in the stratigraphic column. *Three times a week; second semester.*

41. Summer Field Survey.—The field will probably be Eastern Wyoming. Eight weeks in summer. Party limited to 10, approved in advance. (Not given in 1919.)

42. Stratigraphic Paleontology.—The invertebrate index fossils of the successive geologic formations, from the Cambrian to the Tertiary. *Three times a week; both semesters.* Associate Professor Savage

Geological Club.—All members and advanced students of the department participate in this for the purpose of considering the results of investigations, reviews of important publications, and special lectures. *Once a week; both semesters.*

GERMANIC LANGUAGES AND LITERATURE

German

Students desiring to take German as a major are required to have finished successfully a four years' course of undergraduate work in German, comprising a minimum of twenty-eight semester hours of credit. They are also required to be familiar with the principal works of the writers of the classical and modern periods of German literature, to show a general knowledge of the history of German literature, and to be able to follow lectures in the German language.

Of collateral subjects, a reading knowledge of Latin and French is required. It is desirable that candidates for the degree of Ph.D. have some knowledge of Greek. All students are to have had a course in German history.

Courses for Graduates

101. Seminar in Germanic Philology.—Training in original research. Results, when of value, may be published in the *Journal of English and Germanic Philology. Once a week; both semesters. One unit.* Professor Goebel

103. Introduction to the Historical Study of the Germanic Languages.—History of German philology; comparative grammar of the old Germanic dialects. *Twice a week; second semester. One unit.* Professor Goebel

104. Gothic.—Grammar and literature. *Twice a week; first semester. One unit.* Professor Goebel

105. Old High German.—Grammar and interpretation of the oldest literary documents. *Three times a week; second semester. One unit.* Dr. Williams

109. Goethe's and Schiller's Philosophy.—*Twice a week; both semesters. One unit.* (Not given, 1919-20.) Professor Goebel

110. Early German Drama.—German drama up to the Reformation: medieval religious drama, Shrovetide plays, beginnings of the humanistic drama. *Twice a week; first semester. One unit.* (Not given, 1919-20.) Assistant Professor Brooks

113. German Literature of the Fifteenth and Sixteenth Centuries.—Luther and the Reformation, Mastersingers and Folksong, the Reformation drama. Hans Sachs, Brant, Fischart, the chap books, the English comedians. *Twice a week; second semester. One unit.* (Not given, 1919-20.) Assistant Professor Brooks

115. History of German Literature During the Nineteenth Century.—*Twice a week; both semesters. One unit.* Professor Lessing

116. Medieval German Literature with Reference to Political, Religious, and Social History.—Research course. *Twice a week; both semesters. One unit.* (Not given, 1919-20.) Professor Lessing

117. History of German Literature During the Eighteenth Century.—*Twice a week; both semesters. One unit.* Professor Goebel

118. The German Drama Since Schiller.—Research course. *Twice a week; both semesters. One unit.* Professor Lessing

119. The German Novel.—Research course. *Twice a week; both semesters. One unit.* (Not given, 1919-20.) Professor Lessing

121. Walther von der Vogelweide.—*Twice a week; second semester. One unit.* (Not given, 1919-20.) Professor Goebel

121b. Nibelungenlied.—*Twice a week; second semester. One unit.* Professor Goebel

125. History of the German Language.—Evolution of the forms, syntax, and lexicography of the High German literary language. *Three times a week; second semester. One unit.* (Not given, 1919-20.)

Courses for Graduates and Advanced Undergraduates

8. Schiller.—The life of Schiller; *Wallenstein* and other selections. *Three times a week; second semester.* Professor Lessing

19a-19b. Goethe's Faust.—The Faust legend and early Faust books and plays; the genesis of Goethe's *Faust;* reading of both parts. *Twice a week; both semesters.* Professor Goebel

26a. German Literature to the End of the Reformation.—*Three times a week; first semester.* Professor Lessing

26b. German Literature after the Reformation.—*Three times a week; second semester.* Professor Lessing

27. Lessing.—The life of Lessing; *Nathan der Weise, Emilia Gallotti* and other selections. *Three times a week; first semester.* Professor Lessing

31. Middle High German.—*Twice a week; first semester.* Professor Goebel

GREEK

(See Classics)

HISTORY

Graduate work in history requires two years of college work in this subject, or sixteen semester hours, which should ordinarily include introductory courses in European and American history. Linguistic preparation is important especially in French and German. For medieval history some knowledge of Latin is essential, and Spanish is useful for certain fields of American history.

Advanced courses in history at the University of Illinois are of three kinds: (1) Courses for information and guidance in general reading. (2) Instruction in methodology, historiography, and bibliography. A part of this work (in course 103) is required of all graduate students in history during their first year. (3) Seminary courses for the study of special fields with a view primarily to training in the methods of historical criticism and research.

Illinois Historic Survey.—Historical students have an opportunity to pursue research in western history in connection with the Illinois Historical Survey, which is a norganization for the purpose of carrying on systematic studies in the history of Illinois.

Attention is also called to the fact that the University of Illinois has for some time cooperated with the Trustees of the State Historical Library in the gathering and editing of archive material. As a result of this relation instructors and graduate students in the department have contributed from time to time to the publications of the Library and have been given useful training in the study of manuscript as well as printed material.

Higher Degrees in History. The following statement regarding the specific requirements for higher degrees in history is subject to the general requirements of the Graduate School.

Master of Arts

In addition to meeting the usual tests in the specific courses taken, each candidate is required to pass a general oral examination, and written examinations in two of the following fields: ancient history; medieval history of continental Europe; modern history of continental Europe; English history; American history. Candidates for this degree are expected to have a general knowledge of hitsorical bibliography and methodology (see course 103).

Doctor of Philosophy

Major Requirements.—A candidate who selects history as his major subject may offer himself for examination in any four of the fields indicated below, stating also the particular field among these four in which he wishes to specialize and in which his thesis is to be written:

1. Ancient history. 2. Medieval history and institutions of continental Europe, to the close of the thirteenth century. 3. Continental Europe from

1300 to 1648. 4. Continental Europe and its dependencies since 1648 (except as included in 5 and 6). 5. The history of England and its dependencies, (not including America before 1783). 6. American history (except as included in 5, and with primary reference to the United States). This enumeration of fields is not to be regarded as excluding the possibility of accepting others as may be determined by the department in individual cases.

Minor Subjects.—A candidate for the doctorate in history may select as his first minor one of the divisions of the field of history listed above which is not offered as a part of his major. He should preferably, however, select his minors from subjects offered by other departments. The following list of suitable minors is intended to be suggestive rather than exhaustive or compulsory.

I. In Political Science.—(Any two acceptable for a first minor; any one, for a second minor): 1. International law and diplomacy. 2. Modern government. 3. Municipal government. 4. Constitutional and administrative law and jurisprudence. 5. Political theory.

II. In Economics and Sociology.—(Any two acceptable for a first minor; any one, for a second minor): 1. Economic history. 2. Economic theory. 3. Public and private finance. 4. Social reform. 5. Principles of sociology.

III. In Philosophy and Education.—(Any two acceptable for a first minor; any one, for a second minor): 1. History of ancient and medieval philosophy. 2. History of modern philosophy. 3. History of education.

IV. In Literature.—Some division of the history of literature which may be either comparative literature of a limited period or the literature of a particular country for a more extended period as may be agreed upon in each case.

Courses for Graduates

101. Seminar in American History.—Bibliography; practise in the solution of typical problems; reports on the progress of individual investigations by instructors and students. *Two hours, once a week; both semesters. One to two units.* Professor Greene and others

In connection with this course, advice and direction in research are offered in various fields as follows:

A. American history before 1815. Professor Greene

B. American history since 1815.
Associate Professor Robertson, Assistant Professor Cole

C. The history of the West. Professor Alvord

D. American church history. Professor Greene

E. Latin-American history. Associate Professor Robertson

102. Studies in English History.—Church and state in the medieval and early modern period; examination of documentary materials. *Arrange hours; both semesters. One unit.* Professor Larson

103. Historiography and Historical Method.—The technic of historical investigation. Required of all candidates for an advanced degree in history who do not present evidence of similar training elsewhere. *Twice a week; first semester. One-half unit.* Assistant Professor Cole

104. SEMINAR IN ENGLISH AND CONTINENTAL EUROPEAN HISTORY.—European expansion. Bibliography, historiography, and selected problems; reports. *Two hours, once a week; both semesters. One to two units.*

Professor LARSON, Professor LYBYER, Dr. JONES, Dr. PEASE

In connection with this course, advice and direction in research in various fields are offered as follows:

A. Medieval history. Professor LARSON
B. Modern history of continental Europe. Professor LYBYER
C. English history. Professor LARSON
D. Renaissance and Reformation. Dr. JONES
E. Asiatic Relations. Professor GREENE, Professor LYBYER

105. STUDIES IN THE HISTORY OF THE WEST.—The special subject for 1919-20 will be: French Colonization of the Mississippi Valley. *Once a week; both semesters. One unit.* Professor ALVORD

111. SPANISH-AMERICAN RELATIONS.—The relations of the Latin-American states with Europe and the United States; the Monroe doctrine; the development of international trade, etc. *Once a week; both semesters. One-half to one unit.* Associate Professor ROBERTSON

112. STUDIES IN AMERICAN RELIGIOUS HISTORY.—Questions of Church and State. *Twice a week; second semester. One unit.* Professor GREENE

114. STUDIES IN AMERICAN CONSTITUTIONAL HISTORY.—*Twice a week; both semesters.* (Not given, 1919-20.)

Professor GREENE, Associate Professor ROBERTSON

150. RESEARCH IN ORIENTAL HISTORY.—*Both semesters. One unit.*

Professor OLMSTEAD

Courses for Graduates and Advanced Undergraduates

4a-4b. CONSTITUTIONAL HISTORY OF ENGLAND.—Institutional origins; modern constitutional practise. *Three times a week; both semesters.*

Professor LARSON

9a-9b. EUROPEAN SOCIETY IN THE ERA OF THE RENAISSANCE AND THE REFORMATION.—The transition from medieval to modern ideals. *Twice a week; both semesters.* (Not given, 1919-20.) Dr. JONES

12. MEDIEVAL CIVILIZATION.—Considerable attention will be given to intellectual movements. *Twice a week; first semester.* Professor LARSON

13. THE AMERICAN REVOLUTION, 1760-1783.—Colonial institutions on the eve of the Revolution; the controversy with the Mother Country; war and diplomacy; transition from provincial to republican institutions. *Three times a week; first semester.* (Not given, 1919-20.) Professor GREENE

14. STUDIES IN THE DEVELOPMENT OF AMERICAN POLITICAL IDEALS.—*Twice a week; both semesters.* Professor GREENE

15. THE CIVIL WAR AND THE RECONSTRUCTION.—The ante-bellum South and its destruction, 1844-1870. The civil war in the light of the forces which tended to hasten or obstruct the clash of arms. *Three times a week; second semester.* Assistant Professor COLE

16. The History of the Exploration and Colonization of the West.—The Mississippi Valley from the beginning of the Spanish explorations to the close of the War of 1812. The development of the Mississippi Valley since 1815 and the progress of westward expansion to the Pacific. *Twice a week; both semesters.* Professor Alvord

19. French Civilization from the Age of Louis IX to the Present Time.—*Twice a week; second semester.* Dr. Jones

20a. Recent European History, 1848-1891.—The period of national consolidation and world-wide expansion. *Three times a week; first semester.* Professor Lybyer

20b. Recent European History, 1891 to Date.—The formation of alliances, the Balkan wars, and the Great War. *Three times a week; second semester.* Professor Lybyer

21. The Recent History of the United States.—Introduction to contemporary American politics. *Twice a week; first semester.* Associate Professor Robertson

23a-23b. England in the Seventeenth and Eighteenth Centuries.—The influence of Puritanism on the institutions and ideas of England and America. English politics and political thought considered as a background to political theory in the American Revolution. *Twice a week; both semesters.* Dr. Pease

24. European Consolidation and Colonial Expansion, 1648-1789.—*Three times a week; first semester.* (Not given, 1919-20.) Professor Lybyer

25. The French Revolution, Napoleon, and the European Reaction, 1789-1848.—*Three times a week; second semester.* (Not given, 1919-20.) Professor Lybyer

(Courses 24-25 and 20a-20b will ordinarily be given in alternate years.)

26. History of the Latin-American Colonies.—The political, economic, social, and intellectual life of Spain during the period of discovery. The exploration, settlement, and civilization of Spanish America and the Philippines. *Three times a week; first semester.* Associate Professor Robertson

27. History of Latin-America from the War of Independence to the Present Time.—The national history of the leading Latin-American states with Europe and the United States. The old regime in Texas, Mexico, and California. *Three times a week; second semester.* Associate Professor Robertson

29. The Far East.—The contact of Western nations with the Far East from the Portuguese establishments of the sixteenth century to the present time, with special reference to China and Japan. *Three times a week; second semester.* Professor Greene

30a-30b. The Ottoman Empire and the Question of the Near East.—The rise and greatness, and the beginning of the decline, of the Turkish power, 1300 to 1792. Turkey since 1792, with special attention to internal condition and international relations. *Twice a week; both semesters.* Professor Lybyer

31a-31b. THE MOHAMMEDAN WORLD.—Mohammed, the Saracen Empire, and the Moslem civilization, before the crusades. The history and culture, since the first crusade, of the Mohammedan peoples in Europe, Africa, and Asia, except the Ottoman Turks. *Twice a week; both semesters.* (Not given, 1919-20.)
Professor LYBYER

40. THE HISTORY OF THE BRITISH COMMONWEALTH OF NATIONS.—Conditions that led to English expansion; imperial institutions; development of the Colonial Nations. *Twice a week; first semester.* Professor LARSON

52. EAST AND WEST IN ANCIENT TIMES.—History of Persia, Parthia, and the Sassanids, to the Moslem conquest; origins of the Eastern question; interrelation of East and West. *Three times a week; second semester.* (Not given, 1919-20.)
Professor OLMSTEAD

53. ASSYRIAN HISTORY.—Sources, political thought, government of dependencies, parallels to more modern imperial states, and economic life of the Assyrian Empire. *Three times a week; second semester.* Professor OLMSTEAD

HOME ECONOMICS

This department offers graduate work along two lines, one dealing with the applications of the biological and physical sciences to the problems of food and nutrition; the other with the economic problems of the household. In either case the student must offer a minimum of ten hours' work with food, eight with textiles and clothing, five with the house, eight of chemistry, eight of biological science, and three in the principles of economics. In addition each student must offer five additional hours in economics or a second year of chemistry, including quantitative and organic chemistry, according to the line of specialization.

Courses for Graduates

101. HOME ECONOMICS.—Vocational, educational and sociological aspects. *Twice a week; first semester. One unit.* Professor BEVIER

102. SPECIAL INVESTIGATION.—Application of the principles of bacteriology, chemistry, and physiology to the ordinary processes used in the preparation of food; probelms in metabolism and nutrition. *Twice a week; both semesters. One unit.*
Professor BEVIER, Miss WARDELL

103. SEMINAR.—Recent advances in nutrition. *Once a week; both semesters. One-half unit.*
Miss WARDELL

104. ECONOMIC PROBLEMS OF THE FAMILY GROUP.—The economic phases of selected problems of the household. *Twice a week; both semesters. One unit.* (Not given, 1919-20.)

Courses for Graduates and Advanced Undergraduates

4. FOOD AND NUTRITION.—Application of the principles of science to the problems of food and nutrition. *Five times a week; first semester.*
Miss WARDELL

20. INFANT NUTRITION.—*Twice a week; second semester.* Miss WARDELL

28. ORGANIZATION AND MANAGEMENT OF THE HOUSEHOLD.—(Continuation of Home Economics 10.) The relation of the home to public activities; retail

market organization; cooperative buying and housekeeping; community kitchens; laundries. *Twice a week; second semester.* (Not open to graduate students in 1919-20.)

HORTICULTURE

At least twenty hours of collegiate work in horticulture and allied subjects and specific preparation for the chosen topics are required for entrance on major work in this department.

Courses for Graduates

103. OLERICULTURE.—Special problems in vegetables. *Both semesters. One to two units.* Professor LLOYD

108. POMOLOGY.—Special problems in small fruits and orchard fruits. *Both semesters. One to two units.*

Professor BLAIR, Professor CRANDALL, Professor LLOYD, Professor PICKETT

115. FLORICULTURE.—The horticultural status of flowering plants, or special problems in the culture of greenhouse plants. *Both semesters. One to two units.* Professor DORNER

116. NUTRITION OF GREENHOUSE PLANTS.—Lectures and special problems. *Both semesters. One unit.* Assistant Professor LEHENBAUER

Courses for Graduates and Advanced Undergraduates

8. ORCHARDING.—Pomaceous, drupaceous, and nut fruits; orchard management. *Five times a week; first semester.* Professor PICKETT

12. EVOLUTION OF HORTICULTURAL PLANTS.—History, botanical classification, and geographical distribution of cultivated plants; modification under culture; variation. *Three times a week; first semester.* Professor CRANDALL

17. COMMERCIAL ORCHARDING.—(Continuation of Horticulture 8.) Production and business methods in large orchards. A limited number of trips will be taken, cost not to exceed $10.00. For students specializing in pomology. *Five times a week; second semester.* Assistant Professor BAILEY

18. EXPERIMENTAL HORTICULTURE.—Methods and difficulties; planning of experiments; recording and interpretation of results. (For advanced students preparing for experiment station work.) *Five times a week; second semester.* Professor BLAIR, Professor PICKETT

43. GREENHOUSE FERTILIZERS.—Soils and fertilizers; moisture and carbon dioxide content of the air; temperature as related to greenhouse crops. *Three times a week; first semester.* Assistant Professor LEHENBAUER

44. POMOLOGY SEMINAR.—Assigned topics; review of books, current technical journals, and other publications. For seniors and graduates specializing in pomology. *Once a week; both semesters.* Professor PICKETT.

45. PLANT NUTRITION.—Carbohydrates, proteins, organic acids, and other organic compounds of plants and their relation to plant nutrition. *Three times a week; second semester.* Assistant Professor LEHENBAUER

46. MARKETING HORTICULTURAL PRODUCTS.—Fruits and vegetables. For seniors and graduates specializing in horticulture. *Twice a week; first semester.* Professor LLOYD

MATHEMATICS

Students entering on graduate study with a major in mathematics must have had twenty-five semester hours of undergraduate work in mathematics, including a year's course in calculus and a course in theory of equations, or in differential equations. They should be able to read German and French.

Candidates for a doctor's degree taking a first minor in mathematics are expected to have completed a course in calculus and are required to take two one-year courses beyond the calculus; candidates for a doctor's degree taking a second minor are required to complete at least one course throughout a year beyond the calculus.

The courses offered by the department are arranged in cycles of two or of three years, so that a student will have opportunity to take any particular course offered by the department, for which he is qualified, in three years of residence required for the doctor's degree.

Courses for Graduates

100. SEMINAR.—*Three times a week; both semesters. One to two units.* Professor TOWNSEND, Professor MILLER, Professor SHAW, Professor COBLE, Associate Professor CARMICHAEL, Associate Professor EMCH, Assistant Professor CRATHORNE, Assistant Professor KEMPNER, Assistant Professor WAHLIN

101. FUNCTIONS OF REAL VARIABLES.—*Three times a week; both semesters. One unit.* Professor TOWNSEND

102. FUNCTIONS OF A COMPLEX VARIABLE.—*Three times a week; both semesters. One unit.* (Not given, 1919-20.) Professor TOWNSEND

105. CALCULUS OF VARIATIONS.—Simple and isoperimetric problems. *Three times a week; second semester. One unit.* (Not given, 1919-20.) Assistant Professor BLUMBERG

110a. ELLIPTIC FUNCTIONS.—The processes of analysis on which the theory of elliptic function depends; singly periodic functions; etc. *Three times a week; first semester. One unit.* (Not given, 1919-20.) Associate Professor CARMICHAEL

110b. ELLIPTIC FUNCTIONS.—Approach to the theory of doubly periodic functions from the point of view of Weierstross's product expansion, of q-difference equations, and of functional equations; etc. *Three times a week; second semester. One unit.* (Not given, 1919-20.) Associate Professor CARMICHAEL

111a. AUTOMORPHIC FUNCTIONS.—Geometry in the complex plane. The group-theoretic side of the theory. *Three times a week; first semester. One unit.* Professor COBLE

111b. AUTOMORPHIC FUNCTIONS.—Function-theoretic developments and applications of automorphic function. *Three times a week; second semester. One unit.* Professor COBLE

112a. LINEAR DIFFERENCE EQUATIONS.—Elementary theory of differences; equations with constant coefficients; etc. *Three times a week; first semester. One unit.* (Not given, 1919-20.) Associate Professor CARMICHAEL

112b. LINEAR DIFFERENCE EQUATIONS.—General expansion problems. *Three times a week; second semester. One unit.* (Not given, 1919-20.)
Associate Professor CARMICHAEL

113. LINEAR DIFFERENTIAL EQUATIONS IN REAL VARIABLES.—General existence theorems; oscillation theorems and pendulum problems; etc. *Three times a week; first semester. One unit.* Associate Professor CARMICHAEL

114. LINEAR DIFFERENTIAL EQUATIONS IN COMPLEX VARIABLES.—General existence theorems, function-theoretic considerations; etc. *Three times a week; second semester. One unit.* Associate Professor CARMICHAEL

122. MODERN ALGEBRA.—Theory of matrices, systems of linear equations, bilinear and quadratic forms, properties of polynomials, algebraic invariants. *Three times a week; both semesters. One unit.*
Assistant Professor KEMPNER

124. THEORY OF NUMBERS.—*Three times a week; both semesters. One unit.* (Not given, 1919-20.) Assistant Professor WAHLEN

125. CONTINUOUS GROUPS.—Representation of certain continuous transformation groups by means of ordinary complex numbers. Lie's theory of differential equations, etc. *Three times a week; first semester. One unit.* (Not given, 1919-20.) Professor MILLER

126. FINITE GROUPS.—Substitution groups of low degrees. Sylow's theorem; etc. *Three times a semester; second semester. One unit.* (Not given, 1919-20.) Professor MILLER

127. THEORY OF GROUPS.—Advanced course. *Three times a week; both semesters. One unit.* Professor MILLER

129. THEORY OF STATISTICS.—Methods of statistical investigation; application to problems in economics, sociology, and biology. *Three times a week; both semesters. One unit.* (Not given, 1919-20.)
Assistant Professor CRATHORNE

130. INVARIANTS AND HIGHER PLANE CURVES.—Applications of the theory of invariants to higher plane curves, etc. *Three times a week; both semesters. One unit.* (Not given, 1919-20.) Professor COBLE

131. ALGEBRAIC SURFACES.—The applications of homogenous coordinates and the theory of invariants to geometry of three dimensions; etc. *Three times a week. One unit.* Associate Professor EMCH

132a. PROJECTIVE GEOMETRY.—*Three times a week; first semester. One unit.* Assistant Professor BLUMBERG

132b. PROJECTIVE GEOMETRY.—*Three times a week; second semester. One unit.* Assistant Professor BLUMBERG

135. DIFFERENTIAL GEOMETRY.—Applications of the calculus to the theory of curves and surfaces based primarily in the use of Cartesian coordinates; relation of the theory of surface to the theory of invariants of a pair of quadratic differential forms. *Three times a week; both semesters. One unit.* (Not given, 1919-20.)

141. VECTOR METHODS.—The algebras of quaternions, space and analysis, and dyadics; differentials and integrals of space; applications to mechanics,

elasticity, hydrodynamics, electrodynamics, and meteorology. *Three times a week; first semester. One unit.* (Not given, 1919-20.) Professor SHAW

142. GENERAL VECTORS.—The algebras applicable to space of four dimensions, and N dimensions; differential and integral operators; applications to relativity problems of kinematics, mechanics, electrodynamics; general dyadics and applications. *Three times a week; second semester. One unit.* (Not given, 1919-20.) Professor SHAW

143. LINEAR ALGEBRA.—A general study of the theory of linear associative and non-associative algebras, particular consideration of the types of algebras, and their chief representatives; applications. *Three times a week; first semester. One unit.* (Not given, 1919-20.) Professor SHAW

144. GENERAL ALGEBRA.—The general theory of combinations of elements, with a study of the main types such as associativity, commutativity, and other limitation types; applications to the theory of infinite algebras and the theory of general operators. *Three times a week; second semester. One unit.* (Not given, 1919-20.) Professor SHAW

145. FUNDAMENTAL FUNCTIONS.—The theory of orthogonal and biorthogonal functions and expansions in terms of them, with particular study of several well-known cases; applications to the solution of differential and integral equations. *Three times a week; first semester. One unit.* Professor SHAW

146. FUNCTIONAL TRANSFORMATIONS.—The theory of operators which transform functions into functions, particularly those related to the infinite algebras of orthogonal functions; applications to functions of lines, surfaces, etc., and to integro-differential equations; general infinite vector analysis. *Three times a week; second semester. One unit.* Professor SHAW

Courses for Graduates and Advanced Undergraduates

10. THEORY OF EQUATIONS AND DETERMINANTS.—*Three times a week; first semester.* Professor MILLER

16-17. DIFFERENTIAL EQUATIONS AND ADVANCED CALCULUS.—*Three times a week; both semesters.* Professor TOWNSEND

18. CONSTRUCTIVE GEOMETRY.—Space perception; lines, planes, and the simpler surfaces of the second order, studied by parallel and central projection; graphic interpretation of the processes of analytic geometry; analytic discussion of the methods of descriptive geometry. *Three times a week; second semester.* Associate Professor EMCH

19. SOLID ANALYTICAL GEOMETRY.—*Three times a week; second semester.* Professor COBLE

21. METHOD OF LEAST SQUARES.—*Twice a week; first semester.* Professor STEBBINS

23. AVERAGES AND MATHEMATICS OF INVESTMENT.—Meaning, use, and abuse of averages; probability; annuities, insurance, and branches of science; loans and investments; evaluation of investment securities. *Three times a week; second semester.* Assistant Professor CRATHORNE

30-31. ACTUARIAL THEORY.—Life contingencies; construction of life tables; valuation of policies; theory of risk; distribution of surplus; workmen's compensation; investment of funds; etc. *Three times a week; both semesters.* Assistant Professor CRATHORNE

32. HISTORY OF MATHEMATICS.—*Twice a week; second semester.* (Not given, 1919-20.) Dr. LYTLE

35. TEACHER'S COURSE.—Secondary algebra and geometry; educational value; position in course; methods of teaching; correlation; American and foreign methods; order and importance of topics; text-books; literature. *Twice a week; first semester.* Dr. LYTLE

40. FUNDAMENTAL CONCEPTS OF MATHEMATICS.—Development of the number concept; concepts of unity; aggregate, order and correspondence; irrationals and limits, transcendence of e and n; etc. *Twice a week; second semester.* Dr. LYTLE

MECHANICAL ENGINEERING

The prerequisite for graduate work in mechanical engineering is the equivalent of the undergraduate course required for the degree of Bachelor of Science in mechanical engineering in the branches of the subject in which registration is desired.

*Courses for Graduates**

107. THERMODYNAMICS AND HEAT MOTORS.—General theory of thermodynamics with applications. *Twice a week; both semesters. One unit.* Professor GOODENOUGH

109. MACHINE DESIGN.—Rational design; mechanics of materials. Individual problems. *Twice a week; either semester. One unit.* Professor LEUTWILER

112. LABORATORY INVESTIGATIONS.—Combustion of fuels, boiler economy, steam engines and turbines, and similar subjects. *Three times a week; both semesters. One and one-half units.* Professor WILLARD

MECHANICS, THEORETICAL AND APPLIED

The prerequisite for the courses for graduates in theoretical and applied mechanics is the equivalent of the undergraduate courses in theoretical and applied mechanics and in allied engineering subjects required for the degree of Bachelor of Science in engineering.

Courses for Graduates

101. ANALYTICAL MECHANICS.—The historical development of methods of analysis; advanced problems in statics and dynamics; a comparative study of texts. *Twice a week; first semester. One unit.* Professor MOORE

102. RESISTANCE OF MATERIALS.—Analysis and investigation in mechanics of materials; the properties of materials used in engineering construction

*Courses offered to Junior and Senior students are open for minor credit to students majoring in other departments.

and the methods of determining these properties. *Twice a week; second semester. One unit.* Professor MOORE

103. HYDRAULICS AND HYDRAULIC ENGINEERING.—The laws of hydraulics and their application to engineering problems; hydraulic power and its development; design and investigation. *Twice a week; second semester. One-half to one unit.* Professor TALBOT

104. EXPERIMENTAL WORK IN LABORATORY OF APPLIED MECHANICS.—(a) Laboratory investigation in the materials-testing laboratory; (b) experimental work in hydraulic laboratory. *Twice a week; both semesters. One-half to two units.* Professor TALBOT, Professor MOORE, Professor ENGER

105. EXPERIMENTAL AND ANALYTICAL WORK IN REINFORCED CONCRETE.—Research; interpretation of experimental results and their application to the design of structures; principles of construction. *Twice a week; both semesters. One to two units.* Professor TALBOT

*Courses for Graduates and Advanced Undergraduates**

1. ANALYTICAL MECHANICS.—Arranged for graduates and advanced undergraduates in Arts and Sciences. *Three times a week; first semester.* Mr. ENSIGN

2. ANALYTICAL MECHANICS.—A continuation of Theoretical and Applied Mechanics 1. *Three times a week; second semester.* Mr. ENSIGN

41. ADVANCED MECHANICS OF MATERIALS.—Special problems met in engineering. Thick cylinders, guns, curved beams, hooks, chain links, rings, unsymmetrical bending, flat plates, bulkheads; elastic strength of material as affected by heat treatment and over-strain; stresses due to impact loads; resistance of materials to repeated loading; collapsing pressure of thin-walled vessels. Exact versus approximate analyses. Methods of extending approximate analyses. General methods of attack. The application of mechanics to special machine parts and structures. *Three times a week; first semester.* Associate Professor SEELY

METEOROLOGY

(See GEOLOGY)

MINERALOGY

(See GEOLOGY)

MINING ENGINEERING

The prerequisite for graduate work in mining engineering is the equivalent of the undergraduate courses required for the degree of Bachelor of Science in mining in the branches of the subject in which registration is desired.

In addition to the regular University laboratories, the laboratory connected with the investigation of mining conditions in Illinois now being car-

*Courses offered to Junior and Senior students are open for minor credit to students majoring in other departsments.

ried on jointly by the Engineering Experiment Station through the Department of Mining Engineering, the State Geological Survey, and the United States Bureau of Mines, is available for graduate instruction.

Courses for Graduates

NOTE:—Of courses 103, 105, only one will be given, according to election of students.

100. SEMINAR.—*Once a week; both semesters. One unit.* Professor STOEK

101. ADVANCED MINING METHODS.—Coal and ore fields of the United States; methods and economics of mining; utilization, marketing, storage, and transportation of coal and ores. *Twice a week; both semesters. One unit.* Professor STOEK

102. ADVANCED PREPARATION OF COAL AND ORES.—Detailed investigation and discussion of settling ratios; laws of crushing, sorting vs. sizing; specific mill and washing problems. *Twice a week; both semesters. One unit.*

103. HISTORY OF MINERS' ORGANIZATIONS.—*Twice a week; both semesters. One unit.* (Not given, 1919-20.) Professor STOEK

104. MINING REPORTS.—Law of the apex, the classification of coal and ore lands; conservation of mineral resources; mine examination and report. *Twice a week; both semesters. One unit.* Professor STOEK

105. WELFARE WORK AND EDUCATION AMONG MINE EMPLOYEES.—The organization and operation of mining institutes, night classes, welfare, mine rescue, and first-aid work. *Twice a week; both semesters. One unit.* Professor STOEK

MUNICIPAL AND SANITARY ENGINEERING

The prerequisite for graduate work in municipal and sanitary engineering is the equivalent of the undergraduate courses required for the degree of Bachelor of Science in municipal and sanitary engineering in the branches of the subject in which registration is desired.

Courses for Graduates

102. WATER SUPPLY ENGINEERING.—Advanced work arranged to suit the requirements of individual classes. *One to three times a week; first or second semester. One unit.* Professor ENGER

103. SEWERAGE.—General sewerage design and construction; sewerage system; hydraulics of sewers. *Once or twice a week; second semester. One unit.* Professor TALBOT

106. WATER PURIFICATION, SEWAGE DISPOSAL, AND GENERAL SANITATION.—Design, construction, and operation of water purification plants and of sewage disposal works; water filters, sewage tanks, etc.; garbage disposal and general sanitation. *Once a week; second semester. Half unit or more.* Professor TALBOT

*Course for Graduates and Advanced Undergraduates**

6a-6b. WATER PURIFICATION, SEWAGE DISPOSAL, AND GENERAL SANITATION.—Impurities in water supplies and methods and processes of removal; sewage disposal; purification plants; garbage collection and disposal; sanitary restrictions and regulations and general sanitation. *Three times a week; first semester. Twice a week; second semester.*

Professor TALBOT, Assistant Professor BABBITT

ORIENTAL LANGUAGES AND LITERATURES

Courses for Graduates and Advanced Undergraduates

1. ELEMENTARY HEBREW.—Grammar and reading. The Book of Genesis. *Three times a week; both semesters.* Professor OLMSTEAD

2. ADVANCED HEBREW.—Readings in the sources for the early history. *Twice a week; both semesters.* Professor OLMSTEAD

10. ELEMENTARY ASSYRIAN.—Grammar, sign lists, and reading. *Three times a week; both semesters.* (Not given, 1919-20.) Professor OLMSTEAD

PALEONTOLOGY

(See GEOLOGY)

PHILOLOGY

(See COMPARATIVE PHILOLOGY, and ROMANCE PHILOLOGY under ROMANCE LANGUAGES)

PHILOSOPHY

Students entering on graduate work in philosophy must have had a general course in the history of philosophy, a course in logic, and a general course in psychology.

Courses for Graduates

103. SEMINAR IN ETHICS.—British ethics from Hobbes to Sidgwick. *Twice a week; second semester. One unit.* Professor DANIELS

107a-107b-107c. HISTORY OF PHILOSOPHY.—(a) Plato and Aristotle. *Twice a week; first semester. One unit.* Professor DANIELS

(b) Descartes, Spinoza, and Leibnitz. *Twice a week; first semester. One unit.*

(c) Kant and Schopenhauer. *Twice a week; second semester. One unit.*

(The subjects in 1919-20 will be determined by the needs of the students registered.)

108a-108b-108c. SEMINAR IN CONTEMPORARY PHILOSOPHY.—(a) Idealism. *Twice a week; both semesters. One unit.* Professor BODE

(b) Realism and pragmatism. *Twice a week; both semesters. One unit.*

(c) The philosophy of Bergson. *Twice a week; both semesters. One unit.*

(The subjects in 1919-20 will be determined by the needs of the students registered.)

*Other courses offered to Senior students are open for minor credit to students majoring in other departments.

Courses for Graduates and Advanced Undergraduates

3. History of Ancient and Medieval Philosophy.—*Three times a week; first semester.* Professor Daniels

4. History of Modern Philosophy.—*Three times a week; second semester.* Professor Daniels

5. Political Philosophy.—A study of significant theories of the state, ancient, medieval and modern; state sovereignty and morality with special reference to international relations. *Three times a week; second semester.* Professor Daniels

7. Ethics.—The beginning and growth of morality; ethical theory; social and economic problems of the present. *Three times a week; second semester.* Professor Daniels

9. Poltiical and Social Ethics.—A study of the standards and principles of human conduct in political and social relations. Rights and duties of the state and the citizen. International morality. *Three times a week; first semester.* Professor Daniels

11. Philosophy of Religion.—Among the topics considered are: God; revelation; inspiration; dogma; prayer; faith; immortality; the problem of evil; the relation of morality and religion. *Twice a week; second semester.* (Not given, 1919-20.) Professor Daniels

15. British Philosophers of the Eighteenth Century.—Locke, Berkeley, and Hume. *Three times a week; first semester.* Professor Bode

16. Philosophy of Pragmatism.—*Three times a week; second semester.* Professor Bode

PHYSICS

The prequisite for graduate work in physics is a college course in general physics with a year's laboratory course in introductory physical measurements. The student who is to do major work in physics should also have had additional courses in physics or teaching experience, unless the training in his minor subjects, mathematics or chemistry, has been strong and complete. He should also have a knowledge of French and German sufficient to use references in these languages. The courses named below are those open for candidates for the master's or doctor's degree. A large part of the last year's work of the candidate for the doctor's degree is investigational, along either the experimental or the theoretical side of physics. In addition to these major graduate courses, the courses in elementary dynamics, heat, light, electrical measurements, and introductory electrical theory are arranged with certain additions for the graduate credit. The intermediate courses on electricity and magnetism, heat, and light (Physics 15, 16, 17) may be offered with certain additions by candidates for the master's degree and then generally only as minors.

Courses for Graduates

104a-104b. Selected Problems in Electrical Measurements.—(a) Measurement of high and low resistances by refined methods; aperiodic and ballistic galvanometers; damping factor and critical damping resistance of a

galvanometer; electric current and quantity; absolute determination of capacity; the Dolezalek quadrant electrometer; properties of dielectrics; the measurement of v and e—m for cathode rays; positive electricity; the potentiometer. (b) Refined methods of measuring the magnetic properties of iron; plotting of hysteresis curves and the determination of hysteresis losses; the Siemens electrodynamometer; the measurement of self- and mutual-induction by various methods including Hughes induction balance; the Braun discharge tube in magnetic hysteresis; and the study of the characteristics of various forms of discharge tubes in the detection and amplification of electric waves. *Two times a week of three hours each; both semesters. Three-fourths unit.* (Course 104a is recommended for graduate students in chemistry.)

Professor KNIPP

121. RECENT ADVANCES IN PHYSICS AND THE ELECTRON THEORY.—A series of demonstration lectures, in which members of the class will take turns in assisting. The universal occurrence of electrons; properties of the electron, and of the gaseous ion; determination of e—m and v of the electron, and of the ion; use of positive rays (kanal strahlen) in gas analysis; color effects of electrons, of ions, and of retrograde rays in residual hydrogen, helium meon and argon: determination of the elementary charge of the electron by means of the lag method by radioactivity. *Second semester. One-fourth unit.* (Not given, 1919-20.) Professor KNIPP

123. SOUND.—Wave motion; forced vibrations; velocity and energy relations of sound waves; resonance; vibrations of strings and organ pipes. *Four times a week, including one laboratory period; second semester. One unit.*

Professor WATSON

124. CONDUCTION OF ELECTRICITY THROUGH GASES.—A critical study of the phenomena of the conduction of electricity through gases. Lectures and recitations. Selected chapters from Townsend's *Electricity in Gases* and other texts. *Three times a week; first semester. One unit.* Professor KNIPP

126. PHYSICS COLLOQUIUM.—Weekly meetings of the instructors and advanced students of the department for the presentation and discussion of papers on current problems in physics. Attendance is expected of all the graduate students. *Once a week; both semesters. No credit.*

131. INVESTIGATION OF SPECIAL PROBLEMS.—*Two to four times a week; both semesters. One to two units.* Professors CARMAN, KNIPP, WATSON, Associate Professor KUNZ, Assistant Professors SCHULZ, WILLIAMS

132. MATHEMATICAL PHYSICS.—Special phases in theoretical physics.

132a. DYNAMICS.—Lectures on dynamics, special attention being paid to the general principles of dynamics, such as the principle of least action. Special problems are discussed, such as gyroscopic motion, the case of three attracting bodies, etc. The second part of the course will be devoted to hydrodynamics and aerodynamics. *Four times a week; both semesters. One unit.*

Associate Professor KUNZ

132b. ELECTRODYNAMICS.—The potential theory applied to electrical and magnetic polarization; spherical harmonics, images and inversion, conjugate functions, elliptic coordinates and integrals, magnetic actions of currents, de-

termination of coefficients of capacity, self and mutual induction, absolute measurements, Maxwell's theory with some applications in optics. *Four times a week; both semesters. One unit.* (Not given, 1919-20.)

Associate Professor KUNZ

132c. THERMODYNAMICS AND KINETIC THEORY OF MATTER.—Chemical equilibrium; the Nernst theorem; Carnot's cycle; the thermodynamic potentials and the derived functions; Maxwell's theory of the distribution of velocities in a gas; Boltzman's H theory; the theory of radiation, especially Planck's theory of quanta. *Both semesters. One unit.* (Not given, 1919-20.)

Associate Professor KUNZ

132d. ELECTRIC OSCILLATIONS.—Maxwell's theory of the electromagnetic field. Electric oscillations along single and parallel wires; Hertz's oscillator; theory of the antennal propagation of waves over the surface of the earth; absorption; reflection, diffraction and scattering of electric and light waves. From the mathematical point of view, this course may be considered as an application of the potential theory involving spherical and cylindrical harmonics. *Twice a week; first semester. Three-fourths unit.*

Associate Professor KUNZ

133. SEMINAR.—*Three or five times a week; both semesters. One to three units.* Professors CARMAN, KNIPP, WATSON, Associate Professor KUNZ, Assistant Professor SCHULZ

Courses for Graduates and Advanced Undergraduates

4a-4b. ELECTRICAL AND MAGNETIC MEASUREMENTS.—A comprehensive course in exact electrical and magnetic measurements, adapted for general and technical students. *Twice a week; both semesters.* Professor KNIPP

4a-4b. ELECTRICAL AND MAGNETIC MEASUREMENTS.—(Special section for graduate students of chemistry during the first semester.) *Twice a week; both semesters.* Professor KNIPP

14a. INTRODUCTION TO THEORETICAL PHYSICS.—Dynamics. Motion, mass, and force; problems from pure and applied physics. *Three times a week; first semester.* Professor CARMAN

*15. ELECTRICITY AND MAGNETISM.—(Recommended to students in non-technical courses who wish a knowledge of electricity and magnetism beyond the course in general physics.) *Two recitations or lectures and one three-hour laboratory exercise weekly; first semester.* Professor KNIPP

*16. HEAT.—Fundamental heat phenomena, the mechanical theory of heat, and elementary thermodynamics. Thermometry, calorimetry, vapor pressure, expansion of bodies, transmission of heat, mechanical equivalent. *Three times a week; first semester.* Professor WATSON

*17. LIGHT.—Reflection, refraction, interference, diffraction, and polarization; telescopes, microscopes, refractometers, prism and grating spectroscopes, and interferometers. *Three times a week; first semester.*

Assistant Professor SCHULZ

*These courses may be taken for a minor credit or as *first* year major credit only.

20. Light.—Special phenomena; modern theories; readings in Drude, Week, and Preston. *Twice a week; second semester.* Assistant Professor Schulz

22. Advanced Light Measurements.—Wave length determinations with gratings, echelons, and interferometers; spectroscopic work; Zeeman effect; polarimetric analysis; determination of resolving power of instruments; photometry and spectrophotometry. *Twice a week; second semester.*
Assistant Professor Schulz

23. Sound.—Origin, propagation, velocity, and interference of sound; vibration of strings, rods, and gas columns; physical theory of music and speech. *Three times a week; second semester.* Professor Watson

24. Properties of Matter.—Weight; mass; gravitation; elasticity; viscosity; surface tension; diffusion. Measurements including the use of the dividing engine, chronograph, etc. *Twice a week; second semester.*
Assistant Professor Williams

27. Fundamental Physical Measurements.—An advanced laboratory course in measurements of length, mass, time and of determinations of gravitation, elasticity, surface tension, viscosity, etc. *Once or twice a week; second semester. One-half or one unit.* Assistant Professor Williams

30. Introduction to Theoretical Electricity.—Electrical and magnetic phenomena discussed with calculus methods. (For advanced students in physics, chemistry, mathematics, and engineering.) *Three times a week; second semester.* Professor Knipp

33. Sound.—Laboratory experiments in fundamental phenomena in sound. The theory of sound as given in Physics 23 may be taken profitably with this course. *Once a week; second semester.* Professor Watson

40. Present Problems in Physics.—The Electron Theory of Matter. This course discusses recent applications of the electron theory. Some of the special topics will be: Zeeman effect; photoelectricity; phosphorescence; chemical action of light and cathode rays; electron theory of metals; of magnetism; structure of the atom. The method of physical intuition will be used, excluding complicated mathematical analysis. The course would be of interest to students in physics, chemistry, electricity, and natural science in general. Experiments accompanying this course are described under Physics 41, and both courses should be taken at the same time. The course is open to graduates and qualified seniors. *Two lectures per week; second semester.*
Associate Professor Kunz

41. Experiments on Present Problems in Physics.—A series of experimental lectures illustrating some of the more recent discoveries in physics. The main topics to be presented are: the production and measurement of high vacua; the study of electric discharge in vacuum tubes; cathode rays; positive rays; X-rays; Universal occurrence of electrons; the determination of the charge of the electron by electrostatic and magnetic deflection methods, by fog methods, by Brownian movements, and by radioactivity: ionization of gases by X-rays. α, β, and γ rays; photoelectricity; Zeeman effect, and kindred phenomena. This course accompanies Physics 40 and is open to graduates and qualified seniors. *One lecture per week; second semester.* Professor Knipp

PHYSIOGRAPHY

(See Geology)

PHYSIOLOGY

The prerequisites for graduate work in physiology are physiology 1 and 2.

Courses for Graduates

100. Advanced Work in the Physiology of secretion, digestion, absorption, metabolism, excretion, and glands of internal secretion. *Five times a week; either semester. One to two units.* Assistant Professor Burge

101. Journal Club.—Review of literature. *Once a week; both semesters. One-fourth unit.* Members of the staff

102. Research.—*Three times a week; both semesters. One to two units.* Members of the staff

Courses for Graduates and Advanced Undergraduates

5. Physiology of Nutrition.—Utilization of food material by the body in health under various conditions and in disease. *Twice a week; second semester.* Assistant Professor Burge, Miss Neill

7. Physiology of the Special Senses.—*Twice a week; second semester.* Assistant Professor Burge, Miss Neill

POLITICAL SCIENCE

Graduate work in political science is conducted in the following special fields: (1) Political theory; (2) international law and diplomacy; (3) comparative government; (4) constitutional law, administrative law, and jurisprudence; (5) municipal administration.

To be admitted to take political science as a major subject, the student must have done at least 18 hours of undergraduate work in political science, economics, and history, not less than nine hours of which must have been in political science. To take political science as a minor he must have had at least nine hours' work in these fields, including six hours in political science.

If a student making political science his major is taking both of his minors in other departments, one of them must be in history, economics, or sociology.

Several courses given in other departments are so closely related to those in political science that graduate students whose major is political science may be permitted on petition to take such courses as part of their major work. Attention is also called to the technical courses given by the department of municipal and sanitary engineering.

Courses for Graduates

101. History of Political Theories.—Political theories of Aristotle, Machiavelli, Hobbes, Locke, Montesquieu, Rousseau, and others; evolution of American political ideas. *Twice a week; first semester. One unit.*
Professor Garner

102. The Nature of the State.—*Twice a week; first semester. One unit.* (Not given, 1919-20.) Professor Garner

103. Seminar in Political Science and Public Law.—*Once a week; both semesters.* Members of the department

106. International Law as Applied During the European War.—Questions of war law arising during the present European war, such as the rights and duties of neutrals, contraband, right of search, capture, continuous voyage, transfers of flags, blockade. *Twice a week; second semester. One unit.*
Professor Garner

107. Foreign Relations of the United States.—Studies in the principles and practises of American foreign policy. *Once a week; second semester. One unit.* (Not given, 1919-20.)

112. Public Administration.—Comparative studies in national and local administration. War administration. *Twice a week; second semester. One unit.* Professor Fairlie

113. State Government and Administration.—Studies in the organization and methods of state governments in formulating and executing public policies. *Once a week; second semester. One unit.* (Not given, 1919-20.)
Associate Professor Mathews

Courses for Graduates and Advanced Undergraduates

4. Municipal Government.—*Three times a week; first semester.*
Assistant Professor Story

5. Constitutional Law of the United States.—*Three times a week; first semester.* Dr. Potter

6. International Law.—*Three times a week; first semester.*
Professor Garner

7. American Diplomacy.—*Three times a week; second semester.*
Dr. Potter

8. International Organization.—History and forms of international polity; the origin, development and functions of the diplomatic and consular systems; alliances and leagues; international and administrative unions and commissions; international conferences and congresses; contemporary efforts at international organization. *Twice a week; first semester.* Dr. Potter

9. Principles of Jurisprudence.—The nature and sources of law; historical development and comparison of Roman law and the English legal system; English common law in the United States; relation between statutes and judicial decisions; classification of law. *Twice a week; second semester.*
Professor Fairlie

10. ADMINISTRATIVE LAW IN THE UNITED STATES.—Administrative organization; separation of powers and delegation of legislative powers; nature and scope of administrative power; administrative procedure and methods of enforcing governmental commands; remedies of the individual against unlawful official action. *Three times a week; second semester.* (Not given, 1919-20.)

11. CONSTITUTIONAL ASPECTS OF SOCIAL AND INDUSTRIAL PROBLEMS.—The police power; constitutional limitations on legislation concerning the public health and safety; the control of public service corporations and combinations of capital and labor. *Three times a week; second semester.* Dr. POTTER

12. NATIONAL ADMINISTRATION IN THE UNITED STATES.—The President and the Cabinet; the executive departments and the administrative services of the national government war agencies. *Three times a week; first semester.* Professor FAIRLIE

13. STATE ADMINISTRATION IN THE UNITED STATES.—*Three times a week; first semester.* (Not given, 1919-20.) Associate Professor MATHEWS

14. POLITICAL PARTIES.—Development of political parties and their organization and influence on the government mainly in the United States and Great Britain; recent legislation on primaries and nomination methods in this country. *Twice a week; first semester.* Professor FAIRLIE

18. LEGISLATION IN THE UNITED STATES.—Nature of legislative power; representation; legislative organization, procedure and practises; bill drafting; legislative reference bureaus; popular law making; tendencies in legislation. *Three times a week; second semester.* Assistant Professor STORY

21. BRITISH GOVERNMENT.—Political institutions in the United Kingdom and British Possessions. *Twice a week; first semester.* Professor FAIRLIE

22. CONTINENTAL EUROPEAN GOVERNMENTS.—The national political systems of France, Germany, Italy, Austria-Hungary, and Switzerland. *Three times a week; second semester.* Professor GARNER

28. PROBLEMS OF CONTEMPORANEOUS POLITICS.—Reorganization of state government; state socialism; immigration; foreign and colonial policies; parliamentary government; direct popular government. *Twice a week; first semester.* (Not given, 1919-20.) Assistant Professor STORY

34. MUNICIPAL PROBLEMS.—Municipal administration in the United States and Europe; municipal organization and relations to the state; municipal ownership and regulation of public utilities; city planning and housing; police and sanitary administration; municipal finances. *Three times a week; second semester.* Professor FAIRLIE

PSYCHOLOGY

Graduate students who elect psychology as their major subject must have had standard courses, of university grade, both in general psychology and in the psychological laboratory. One general university course is the minimal requirement for graduate students who apply to the department for a minor subject.

Courses for Graduates

103. Research.—Experimental and historical investigations. *Both semesters. One-half to two units.*

Professor Bentley, Associate Professor Ruckmich, Dr. Rahn

105. Seminar.—Current topics in their historical setting. *Once a week, two hours; both semesters. One-half unit.* Professor Bentley

Courses for Graduates and Advanced Undergraduates

5-6. Comparative Psychology.—Mind in the animal forms. *Twice a week; both semesters.* Professor Bentley, Dr. Rahn

9. Physiological Psychology.—The psychophysical relationships. *Three times a week; second semester.* Dr. Rahn

10. Translation of Psychological Treatises.—Reading and systematic interpretation of standard works in foreign languages. *Once a week; first semester.* Professor Bentley

12-13. Minor Problems.—Methods suitable to new problems. *Two to five times a week; both semesters.*

Professor Bentley, Associate Professor Ruckmich, Dr. Rahn

14. Social Psychology.—The social consciousness, its factors and conditions; the psychology of peoples. *Three times a week; first semester.*

Dr. Rahn

15. The Psychological Basis of Music.—Development of melody, rhythm, and harmony, auditory phenomena pertaining to music; tests of musical aptitude. *Twice a week; second semester.*

Associate Professor Ruchmich

16. Genetic Psychology.—Instinctive responses; habits; development of mental functions in the child from birth to maturity. *Twice a week; first semester.* Associate Professor Ruchmich

17. The History of Psychology.—*Twice a week; second semester.* (Not given, 1919-20.) Associate Professor Ruchmich

20. Systematic Psychology.—*Three times a week; second semester.*

Professor Bentley

21-22. Special Studies.—Individual investigation for advanced students. *Three times a week; both semesters.*

Professor Bentley, Associate Professor Ruchmich, Dr. Rahn

RAILWAY ENGINEERING

The prerequisite for graduate work in railway engineering is the equivalent of the undergraduate courses required for the degree of Bachelor of Science in railway engineering in the branches of the subject in which registration is desired.

Courses for Graduates

102. Locomotive Design.—Steam pressure, compounding, superheating, etc. *Once a week; both semesters. One unit.* Associate Professor Snodgrass

106. Locomotive Operation.—Train resistance and locomotive tractive effort; tonnage ratings. *Once a week; both semesters. One unit.*

Associate Professor Snodgrass

108. Electric Railways.—Design, selection, and operation of electric railway equipment. *Once a week; both semesters. One unit.*

Professor Rood

110. Railway Location.—Effects of the location of a railway on its earning capacity; engineering and economic problems met with in original location; relocation and reduction of grades of existing lines. *Once a week; both semesters. One unit.* Professor King

Courses for Graduates and Advanced Undergraduates

6. Locomotives.—*Four times a week; second semester.*

Associate Professor Snodgrass

33. Economic Theory of Railway Location.—*Four times a week; second semester.* Professor King

64. Electric Railway Practise.—*Three times a week; first semester.*

Professor Rood

65. Electric Railway Economics.—*Four times a week; second semester.* Professor Rood

RHETORIC

(See English)

ROMANCE LANGUAGES AND LITERATURES

Before entering upon the study of Romance Languages as a major for the degree of A.M., the candidate must have had at least (a) three years of college work in one Romance language, together with a satisfactory reading knowledge of another; or (b) two years of college work in each of two Romance languages. In either case a reading knowledge of German is highly desirable. Before being accepted as a recognized candidate for the degree of Ph.D., he must have had in addition satisfactory training in Latin, and must be able to read ordinary German prose. Before entering on the study of Romance languages as a first or second minor, the candidate must have had two years of college work in the language desired.

French

Courses for Graduates

101. Old French Epic Literature.—Reading and interpretation of the greater national and courtly epics; the history of these types of medieval literature. *Twice a week; both semesters. One unit.* (Not given, 1919-20.)

Professor Oliver

102. Old French Lyric and Prose Literature.—Interpretation of the earlier Old French didactic, chronicle, and lyric writers. *Twice a week; both semesters. One unit.* Professor Oliver

106. Early French Drama.—Origins of the drama in France, and its development up to the Renaissance. *Twice a week; both semesters. One unit.* (Not given, 1919-20.) Professor Carnahan

103. Seventeenth Century Prose Writers.—French culture, society, and prose literature of the seventeenth century; great preachers and moralists; Jansenism and Port Royal; formation of the classic ideals. *Once a week; both semesters. One-half unit.* Professor Oliver

104. Eighteenth Century Prose Writers.—Society, culture, and prose literature of the eighteenth century. The attack on the classic ideals; growth of the revolutionary spirit. *Once a week; both semesters. One-half unit.* (Not given, 1919-20.) Professor Oliver

127. French Romanticism.—Origin and development of the Romantic movement in France. *Twice a week; both semesters. One unit.* Professor Carnahan

Courses for Graduates and Advanced Undergraduates

10a-10b. General Survey of French Literature.—The main currents of French literature from the beginning to the present time. *Three times a week; both semesters.* Professor Carnahan

24a-24b. French Drama of the Seventeenth and Eighteenth Centuries.—Corneille, Racine, Moliere, Voltaire, Marivaux, Sedaine, Beaumarchais. *Three times a week; both semesters.* Professor Oliver

17a-17b. French Drama of the Nineteenth Century.—Hugo, Dumas, Augier, Sardou, Becque, Brieux, Lavedan, Hervieu, Rostand. Dramatic criticism. *Twice a week; both semesters.* Professor McKenzie

42. The French Novel.—From 1850 to the present time. Lectures, reports, and collateral reading. *Twice a week; both semesters.* Dr. Hamilton

47. French Literary Criticism in the Nineteenth Century.—Sainte Beuve, Taine, Brunetiere and other critics. Lectures and reports. *Three times a week; second semester.* (Not given, 1919-20.)

55. Contemporary French Literature.—Writers of the present generation. *Three times a week; first semester.* (Not given, 1919-20.)

Italian

Courses for Graduates

140. Italian Literature of the Thirteenth and Fourteenth Centuries.—Dante, Petrarch, Boccacio. *Twice a week; first semester. One unit.* Professor McKenzie

143. Italian Literature of the Fifteenth and Sixteenth Centuries. —*Twice a week; first semester. One unit.* (Not given, 1919-20.) Professor McKenzie

146. Modern Italian Literature.—Italian writers of the nineteenth century. *Twice a week; second semester. One unit.* Professor McKenzie

Course for Graduates and Advanced Undergraduates

2a-2b. Italian Literature.—Reading; composition; conversation. Introduction to Dante. *Twice a week; both semesters.* Professor McKenzie

Spanish

Courses for Graduates

132. The Novela of the Golden Age.—Political and social conditions in Spain from 1560 to 1700; the kinds of prose fiction produced in this period; *Don Quixote* and the *Novelas Exemplares* of Cervantes. *Twice a week; both semesters. One unit.* Professor Fitz-Gerald

133. Origin of the Spanish Novela and of the Comedia.—The development of Spanish prose fiction and of Spanish dramatic art for the period previous to the Golden Age. *Twice a week; both semesters. One unit.* (Not given, 1919-20.) Professor Fitz-Gerald

134. The Spanish Ballad.—Types of the ballad. *Twice a week; both semesters. One unit.* (Not given, 1919-20.) Dr. Seymour

135. The Modern Novel in Spain.—Development of the modern novel in Spain from the middle of the nineteenth century to the present time. Development of the novel in Spain, France, and Italy. *Twice a week; both semesters. One unit.* Dr. Seymour

137. Spanish Satire.—Development of satire in Spanish literature from the earliest monuments to the present. *Twice a week; both semesters.* (Not given, 1919-20.) Dr. Seymour

139. Spanish Literature in the Middle Ages.—Lectures on the history of Spanish literature from its origin through the reign of John II on Castile. *Twice a week; both semesters. One unit.* Hours to be arranged. (Not given, 1919-20.) Professor Fitz-Gerald

Courses for Graduates and Advanced Undergraduates

10a-10b. General Survey of Spanish Literature.—*Twice a week; both semesters.* Dr. Seris

11a-11b. Spanish Drama of the Sixteenth and Seventeenth Centuries.—Dramatists of the classical period; Lope de Vega, Calderon, Tirso de Molina, and Ruiz de Alarcon. *Twice a week; both semesters.* Dr. Seymour

17a-17b. Spanish Drama in the Nineteenth Century.—*Twice a week; both semesters.* Dr. Van Horne

Romance Philology

Courses for Graduates

171. Introduction to Romance Philology.—Historical phonology and morphology of the Romance languages. *Twice a week; both semesters. One unit.* Professor Fitz-Gerald

175. Old French Phonology and Morphology.—Development of Old French from Vulgar Latin. *Once a week; both semesters. One-half unit.* (Not given, 1919-20.) Professor Fitz-Gerald

179. Old Provencal.—Historical grammar; selected texts. *Once a week; both semesters. One-half unit.*

181. Origin and Formation of the Italian Language.—Thirteenth century texts. *Twice a week; second semester. One unit.* (Not given, 1919-20.) Professor McKenzie

185. Oldest Monuments of the Spanish Language; Origins of Spanish Poetry.—Historical grammar and paleography; interpretation of texts. *Twice a week; both semesters. One unit.* Professor Fitz-Gerald

191. Fables and Bestiaries.—History of animal literature, especially the medieval French and Italian collection. *Twice a week; second semester. One unit.* (Not given, 1919-20.) Professor McKenzie

195. Seminar.—Research work in preparation for theses in the field of Romance languages. *Both semesters. One unit.* Members of the department

SCANDINAVIAN LANGUAGES

(See English)

SOCIOLOGY

Preparation for graduate work in sociology must include at least the equivalent of twelve semester hours in the social sciences, of which at least three must be in sociology, and three in the principles of economics. The remainder may be in any combination of these two subjects, or of history and political science.

Courses for Graduates

100. Bases of Social Theory.—*Twice a week; first semester. One unit.* Professor Hayes

101. Sociological Method.—Adaptability to sociological investigation of methods described in Pearson's *Grammar of Science*, Wundt's *Methodenlehre, zweite abtheilung*, Seignobos' *La Methode Historique Appliquee aux Sciences Sociales*, Bernheim's *Historische Methode*, Spencer's *Study of Sociology*, and Giddings's *Inductive Sociology. Three times a week; first semester. One unit.* Professor Hayes

102. The Development of Sociology.—*One session, two hours, each week; both semesters. One unit.* Professor Hayes

150. Seminar.—Preparation of theses; detection and statement of problems. *One session of two hours each week; both semesters. One to two units.* Professor Hayes

(Note: One of the three courses last described will be omitted in 1919-20; which one is omitted will depend on the election of students.)

Courses for Graduates and Advanced Undergraduates

2. Social Psychology and Social Control.—Current tendencies in the psychological interpretation of social life; ways in which the sentiments, opinions, and conduct of the members of society are shaped. *Three times a week; second semester.*

3. Social Evolution.—The explanation of progressive social change, derived by applying the comparative method to ethnographic and historical materials relating to family organization, practical arts, economic wants and institutions, government and law, moral codes, and religions as they have appeared among savage, barbarous, and civilized peoples. *Three times a week; second semester.* Professor Hayes

8. Charities.—The evolution of modern organized philanthropy, public and private; causes and prevention of poverty; organization and management of charitable institutions. *Three times a week; first semester.* Dr. Sutherland

9. Criminology.—Nature, causes, and treatment of the criminal; evolution of modern methods of criminal procedure and penology; recent experiments and tendencies. *Three times a week; second semester.* Dr. Sutherland

10. Problems of Population.—*Three times a week; first semester.* Dr. Sutherland

12. See Labor Problems (Economics 12).—*Three times a week; both semesters.* Assistant Professor Watkins

14. Social Statistics.—Social investigation and research. Social and community surveys. The verification of sociological principles by means of statistical method. *Three times a week; second semester.* Dr. Sutherland

15. The Family.—Evolution of the family and marriage; educational, moral, and political significance of the family at different stages of social development. *Three times a week; first semester.* (Not given, 1919-20.)

21. See Socialism and Economic Reform (Economics 21).—*Twice a week; second semester.* Assistant Professor Watkins

26. Social Education.—(1) The extent to which and the processes by which individuality is shaped through social contacts and group membership. (2) The variability of societies consequent upon such social modification of the ideas, sentiments, and traits of their individual members, as shown by comparative study of societies and groups. *Twice a week; second semester.* (Not given, 1919-20.) Professor Hayes

SPANISH

(See Romance Languages)

ZOOLOGY

At least sixteen semester hours of college work in zoology are required for entering on major graduate study in this subject. Under special circumstances advanced work in closely allied subjects may be accepted in lieu of the fourth semester's work in zoology. When zoology is chosen for a minor the courses listed for graduates and undergraduates must be preceded by at least one full year's undergraduate work in zoology.

For the prosecution of graduate study in zoology a reading knowledge of German and French is indispensable and familiarity with Latin and Greek is of great advantage.

Every candidate for the doctor's degree is expected to spend at least one summer in study at the seashore. To facilitate this plan an investigator's room has been provided at the Woods Hole Marine Biological Laboratory, where members of the department are afforded research facilities without cost to themselves. Application for the use of this room should be made to the head of the department early in the year. Similar facilities are afforded at the Harpswell Marine Laboratory.

Courses for Graduates

102. Selected Topics from Vertebrate Morphology.—Origin of vertebrates and of the different classes; segmentation of the head; morphology of special systems. *Twice a week; first semester. One-half unit.*

Professor Kingsley

107. Parasitology.—Structure and life history of animal parasites; their relations to disease; origin and biological significance of parasitism. *Second semester. One-half unit each.* (Given in 1918-19 and in alternate years.) Professor Ward

109-109a. Physiological Ecology.—The regulatory mechanism of organisms; neutrality, osmotic pressure, immunity, and temperature in relation to natural environment. 109 *twice a week;* 109a assigned readings and reports. *Second semester. One-half unit each.* (Given in 1918-19 and in alternate years.)

Assistant Professor Shelford

110-110a. Economic Ecology.—Application of principles of physiology and ecology to problems of fisheries and pollution; quantity and weather; forestry and conservation. 110 *twice a week;* 110a assigned reading and reports. *Second semester. One-half unit each.* (Given in 1919-20 and in alternate years.) Assistant Professor Shelford

111. Experimental Ecology.—Repetition of published experiments in physiology and ecology, and study of modern methods and apparatus. *Both semesters. One-half to two units.* Assistant Professor Shelford

115. Factors of Individual and Racial Development.—Experimental embryology; regeneration; heredity; variation; evolution. *Twice a week; both semesters. One unit.* Professor Zeleny

117. Faunistic Zoology.—Taxonomy and distribution, with especial reference to the local fauna; laboratory and field work. *Three times a week; first semester. One unit.* Professor Smith

127. Theories of Animal Phylogeny.—Relations of various groups of animals; signification of so-called intermediate forms; invertebrate larval forms and theories of descent based on them. *Once or twice a week; both semesters. One unit.* (Given in 1919-20, and in alternate years.)

Professor Ward

Individual Research Courses

121. Invertebrate Morphology and Parasitology.—*One to two units.*

Professor Ward

122. Vertebrate Morphology.—*One to two units.* Professor Kingsley

123. Faunistic and Systematic Zoology.—*One to two units.*
Professor Smith

124. Experimental Zoology.—*One to two units.* Professor Zeleny

125. Animal Ecology and Behavior.—*One to two units.*
Assistant Professor Shelford

Courses for Graduates and Advanced Undergraduates

8a-8b. Thesis Investigation.—Individual work on assigned topics. *Both semesters.* Various instructors

11. Experimental Ecology and Geography.—The physiology of environmental relations, facts, principles, and methods of analysis of behavior. World and regional aspects of behavior and ecology including animal distribution as related to climate and vegetation. *Two or four times a week; first semester.*
Assistant Professor Shelford

20a-20b. Current Investigations.—A critical analysis of the results of recent zoological investigations. (Open to all students of zoology; should be taken by those intending to graduate with a thesis.) *Once a week; both semesters.* Professor Zeleny

21a-21b. Introduction to Zoological Research.—Morphology, life-history, or reciprocal relations of invertebrate animals, especially parasitic forms. *Two to five times a week; both semesters.* Professor Ward

22-23. Morphology of Vertebrates.—Detailed studies of systems of organs from the comparative standpoint. *Two to five times a week; both semesters.* Professor Kingsley

25-26. Experimental Zoology.—Experimental embryology; regeneration: heredity; variation; evolution. *Two to five times a week; both semesters.*
Professor Zeleny

63. Ontogeny of Vertebrates.—Comparative studies of germ layers and early organogeny, with graphic and plastic reconstructions. Based chiefly upon Elasmobranchs and Amphibians. Open to seniors and graduates. *Twice a week; first semester.* Professor Kingsley

66. Ontogeny of Vertebrates.—Studies of the development of selected systems of organs. Open to seniors and graduates. *Three times a week; second semester.* Professor Kingsley

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UNIVERSITY OF ILLINOIS BULLETIN
ISSUED WEEKLY
VOL. XVIII SEPTEMBER 13, 1920 NO. 2
[Entered as second-class matter December 11, 1912, at the post office at Urbana, Illinois, under the Act of August 24, 1912. Acceptance for mailing at the special rate of postage provided for in section 1103, Act of October 3, 1917, authorized July 31, 1918.]

THE GRADUATE SCHOOL

OF THE

UNIVERSITY OF ILLINOIS

1920-1921

PUBLISHED BY THE UNIVERSITY OF ILLINOIS
URBANA

THE UNIVERSITY OF ILLINOIS

THE STATE UNIVERSITY

THE UNIVERSITY INCLUDES

The Graduate School, which offers courses of graduate study in all departments of the University.

The College of Liberal Arts and Sciences.

The College of Commerce and Business Administration.

The College of Engineering and the Engineering Experiment Station.

The College of Agriculture and the Agricultural Experiment Station.

The College of Law.

The College of Education.

The College of Medicine (Chicago.)

The College of Dentistry (Chicago.)

The Schools of Music, Library Science, and Pharmacy (Chicago.)

The Summer Session of eight weeks, held each summer.

The State Laboratory of Natural History, the State Geological Survey, the State Water Survey, located at the University, all offer unusual facilities for research.

The Libraries at Urbana contain 436,376 volumes and 51,056 pamphlets.

For catalogs and information address

The University Registrar,

Urbana, Illinois.

THE GRADUATE SCHOOL

OF THE

UNIVERSITY OF ILLINOIS

Announcement for
1920-1921

PUBLISHED BY THE UNIVERSITY OF ILLINOIS
URBANA

REVIEW PRINTING AND STATIONERY CO.
DECATUR, ILLINOIS

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The Superintendent of Public Instruction ..... *Ex Officio*
FRANCIS G. BLAIR ..... Springfield

	Term Expires
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Robert R. Ward, Benton	1921
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THE UNIVERSITY CALENDAR
1920-1921

As Applicable to the Graduate School

First Semester, 1920-1921

1920	
Sept. 20, 21, Monday, Tuesday	Registration days
Sept. 22, Wednesday, 8 a. m.	Instruction begun
Nov. 1, Monday, 5 p. m.	Latest day for announcement of subjects for graduate theses
Nov. 25, Thursday	Thanksgiving Day
Dec. 3, Friday	Illinois Day
Dec. 22, Saturday, 11 a. m.	Holiday recess begun
Dec. 31, Friday, 5 p. m.	Latest day for submission of outlines of theses by candidates for professional degrees in engineering
1921	
Jan. 3, Monday, 1 p. m.	Instruction resumed
Jan. 27, Thursday	Semester examinations begun
Feb. 3, Thursday	Semester examinations ended

Second Semester, 1920-1921

Feb. 7, 8, Monday, Tuesday	Registration days
Feb. 9, Wednesday, 8 a. m.	Instruction begun
Feb. 12, Saturday	Lincoln Day
March 24, Thursday, 11 a. m.	Easter recess begun
March 29, Tuesday, 1 p. m.	Instruction resumed
April 1, Friday, 5 p. m.	Latest day for filing of completed theses by candidates for professional degrees in engineering
May 14, Saturday, 12 m.	Latest day for receipt by the Dean of the Graduate School of certified copies of doctors' theses
June 2, Thursday, 8 a. m.	Final examinations begun
June 4, Saturday, 12 m.	Latest day for receipt by the Dean of the Graduate School of certified copies of masters' theses
June 9, Thursday	Final examinations ended
June 12, Sunday	Baccalaureate address
June 14, Tuesday	Alumni Day
June 15, Wednesday	Fiftieth Annual Commencement

THE EXECUTIVE FACULTY

David Kinley, Ph.D., LL.D., *President*

Arthur Hill Daniels, Ph.D., *Professor of Philosophy and Acting Dean of Graduate School*
William Leonidas Burlison, Ph.D., *Professor of Crop Production*
Albert Pruden Carman, A.M., D.Sc., *Professor of Physics*
Walter Castella Coffey, M.S., *Professor of Sheep Husbandry*
Julius Goebel, Ph.D., *Professor of Germanic Languages*
Laurence Marcellus Larson, Ph.D., *Professor of History*
William Albert Noyes, Ph.D., LL.D., *Professor of Chemistry*
William Abbott Oldfather, Ph.D., *Professor of Classics*
Christian Alban Ruckmick, Ph.D., *Associate Professor of Psychology*
Stuart Pratt Sherman, Ph.D., *Professor of English*
Arthur Newell Talbot, C.E., *Professor of Municipal and Sanitary Engineering*
Edgar Jerome Townsend, Ph.D., LL.D., *Professor of Mathematics*
Henry Baldwin Ward, Ph.D., *Professor of Zoology*
Edward Wight Washburn, Ph.D., *Professor of Ceramic Chemistry*

HISTORY AND ORGANIZATION

The University of Illinois offered facilities for advanced study and research in various lines as early as 1872. Organized graduate instruction, however, under the name of the Graduate School, was first undertaken in 1892. In 1894 the administration of the school was vested in the Council of Administration, and the Vice-President of the University became Dean of the School. In 1906 the Graduate School was organized as a separate faculty, consisting of a dean and members of the University faculty assigned to this duty by the President.

By action of the Trustees the teaching faculty of the Graduate School includes all members of the University faculty who give instruction in approved graduate courses. The affairs of the School, however, are in charge of the Executive Faculty appointed each year by the President.

ADMISSION

Admission to the Graduate School may be granted to graduates of institutions whose requirements for the bachelor's degree are substantially equivalent to those of the University of Illinois, and to applicants from other institutions approved by the Executive Faculty, as hereinafter provided. *Admission to the Graduate School does not, however, imply admission to candidacy for an advanced degree, and gives no right or claim to be so admitted. Such candidacy is determined by the Faculty after the student has demonstrated by his work here, for from two to five months, that he has the ability to do major work of graduate character. A mere accumulation of "credits" or "grades" is not sufficient.*

A graduate of an institution meeting the requirements of a standard college as described below, may be admitted to the Graduate School, provided he satisfies the Dean and the departments concerned that he will be able to proceed to the master's degree in a period not exceeding two years.

For purposes of admission to the Graduate School a *standard college* is one which meets the following requirements:

1. An enrollment of not fewer than one hundred students of college grade, with an average for a series of years of at least twenty-five per cent registered in the junior and senior classes.

2. A graduation requirement of four years (120 semester hours) of collegiate grade.

3. A minimum entrance requirement of 14 units. By the minimum requirement is meant the smallest number of units with which a student may be permitted to begin college work, i. e., the nominal requirement minus the number of units of conditions allowed.

4. A requirement that all entrance conditions must be removed before a student may be permitted to begin a second year of work in the same institution.

5. Not less than eight distinct departments in liberal arts and sciences, with at least one professor giving full time to college work in each department.

6. A minimum educational attainment of all college teachers of academic subjects equivalent to graduation from a college of high grade and graduate work equal to that required for the master's degree at the University of Illinois.

7. A maximum of 16 semester hours per week required of college teachers.

8. A maximum enrollment of 30 students in recitation or laboratory sections.

9. Buildings and equipment of the value of at least $100,000.

10. A productive endowment sufficient to yield a net annual income of at least $10,000 available for instructional purposes in the college department (liberal arts and sciences). If the institution offers courses in addition to the usual liberal arts course, it shall have a correspondingly larger income.

11. A library of not less than 10,000 bound volumes in addition to public documents.

12. Laboratory equipment of a value of not less than $3,000 in physics ($4,000 if work is offered in advance of one-year course), $2,500 in chemistry, and $2,500 in biology.

13. In addition to the foregoing specific requirements, the general standard of the administration and faculty shall be considered.

Admission to graduate courses may be granted only to those who have had the requisite undergraduate work in those courses or departments. But a student of mature age who satisfies the Dean and the department concerned of his ability to pursue graduate work in a given line may be enrolled in particular graduate courses, without reference to a degree, and permitted to carry on such study or investigation under the direction of a department of the University as the department shall recommend and the Dean approve.

Application blanks for admission may be secured from the Registrar of the University. Every applicant must submit with his application for admission an official transcript of his college record.

CHARACTER OF GRADUATE WORK

The principal aim of graduate study is the development of the power of independent work and the promotion of the spirit of research. Each candidate for a degree is expected to have a wide knowledge of his subject and of related fields of work; for the graduate student is not expected to get from lecture and laboratory courses all the knowledge and training necessary to meet the requirements for his degree.

Students, especially candidates for the doctor's degree, are warned against restricting themselves to the courses prescribed or suggested by the departments in which they are studying. Each student is expected to do a wide range of private reading and study, and in many cases will find it advisable to take one or more courses of lectures quite outside the field of his chosen subject.

REGISTRATION AND PROGRAM OF STUDY

The following regulations concerning registration and program of studies are laid out primarily for first-year students. Second-year and third-year graduate students fill out their programs irrespective of the unit value of courses, according to their needs, under the advice of their instructors.

Registration.—Each graduate student must register when he first connects himself with the University and afterwards at the beginning of each semester.

The registration of a new student may be accepted at any time provided the student is prepared to take up courses actually under way. Credit towards the fulfillment of the residence requirement dates, however, from the time of registration and not from the beginning of the semester or year in which the student enters. Registration will not be permitted later in the year than April 1, except in the case of students who expect to continue through the summer session, or are returning to complete a year's work which has been broken into by illness or other unavoidable interruption.

The first registration, or that upon entrance, is permitted only after the student's application for admission to the Graduate School, setting forth his educational attainments, has been duly approved.

A new student must fill out in duplicate an application for admission and submit it to the Registrar, from whom, after the approval of his application, he will receive a card of admission and a study-list which will give details of procedure in registering. He should fill out the study-list after consultation with his adviser, or the person in charge of his major work, and also with the instructors whose courses he wishes to elect. *In all cases, registration must be completed within two weeks.* Otherwise it is subject to a fee of one dollar.

Changes in Study-Lists.—A graduate student is expected to plan his work so carefully that changes in his study-list during the semester will not be necessary. When a change seems advisable, however, it may be permitted without fee if made within three weeks of the date of registration. After that date a fee of one dollar is charged for each change, except that the total charge for a rearrangement authorized on any one change slip shall not exceed two dollars.

Advisers.—The person in charge of the major work of the student becomes his adviser, and, together with those with whom the student is taking first and second minor courses, forms a committee with general supervision over the student's general course of study. This committee is expected to follow the student's work, to assist him in planning his course and to give him such advice as may be necessary concerning his scholastic career.

Advanced Undergraduate Courses Open to Graduate Students. 1. *Courses not open to students below senior standing.* Unless otherwise specified on the student's program by the department concerned, such courses listed for four or five hours of undergraduate credit, are treated as unit courses for graduate credit; or as half unit courses when listed for less than four hours of undergraduate credit.

2. *Courses open to students of junior standing.* Unless otherwise specified on the student's program by the department concerned, such courses listed for four or five hours of undergraduate credit are treated as half-unit courses for graduate credit, or as quarter-unit courses when listed for two to three hours undergraduate credit. Courses to which sophomores are regularly admitted may not be taken for graduate credit, either major or minor.

Transfer of Undergraduate Credit.—No credit earned during the undergraduate course may be transferred for graduate credit, unless such credit was earned in time additional to the time normally required for the bachelor's degree, in the second semester of senior year, and then only for minor subjects, and on petition. When undergraduate courses with variable semester hours are counted for graduate credit, the transfer is made on the basis of one unit for four semester hours.

Seniors and Graduate Study.—If at the end of the first semester of his senior year a student has so far completed his work for the bachelor's degree that his program for the second semester is not full, he may elect one or more graduate courses. But such election must be in accordance with Graduate School rules and must be approved by the Dean at the time of registration. *In no case may courses be counted for graduate credit on a program which requires more than twelve formal class, lecture or laboratory exercises a week, without petition.*

Miscellaneous and Listeners' Courses.—Graduate students are permitted under proper circumstances to attend classes as listeners, and to elect miscellaneous subjects, that is, courses which do not count towards an advanced degree. Listeners' cards may be obtained at the Dean's office. Under the authority conferred by the faculty on the Dean no student with a full minimum program will be permitted by the Dean to visit more than one class or to take more than one miscellaneous subject, nor is any subject open as a listener's or miscellaneous course unless it has a specific educational bearing on the student's major or minor subjects of study.

A student who elects a miscellaneous course is required to register in it, do the work, and pass the semester examinations, unless he is permitted to withdraw under the rules. A student who has a listener's card is not permitted to participate in the classwork or the examination.

No student may register for a full minimum program of work for graduate credit if it is necessary for him to carry at the same time more than one miscellaneous subject and to visit one course.

Students on the Staff.—Assistants and others on the University staff who undertake to do graduate work are permitted to take an amount of work determined by the terms of their employment. Such a student, if required by his engagements to teach more than five classes a week or to have laboratory work or supervision exceeding ten hours a week, may not receive his master's degree at the end of one year, nor his doctor's degree at the end of three.

The enrollment of a member of the staff is subject to the approval of the officer to whom he is responsible as a member of the staff and of the Dean of the Graduate School with reference to the amount of work to be taken. Before credit may be recorded for such graduate student at the end of a semester, the head of the department in which he is employed, or some one authorized by the head, must certify that the time given to graduate work by the student has not impaired the work for which he is paid by the University.

Residence and Work Done Elsewhere.—Continuous residence and study are required of all members of the Graduate School, unless they are granted leave of absence by the Dean, upon recommendation of the professor in charge

of their work, for the purpose of carrying on elsewhere studies or investigation in the line of work for their degrees.

Credit for work done elsewhere is not transferred. The candidate is examined here on all the work required for the degree.

Graduate Study in the Summer.—Graduate students in the summer session are subject to the same scholastic requirements as those in the regular University year. Their study lists must be approved by the Dean of the Graduate School, or his representative. Attendance on four summer sessions, or one semester and two summer sessions, is considered the equivalent of one year in residence. If in these sessions the required amount of work is properly done a master's degree may be earned in this way. The faculty is unwilling to accept summer-session work beyond the master's degree towards the doctor's degree, except in the case of a student who works in a summer session preceding or following a regular year's attendance at the University. In no case may the last year's work for the doctorate be done in disconnected summer sessions.

No course offered in the summer session may be taken for credit towards a higher degree unless it is specially described in the summer-session circular as accepted for that purpose.

Summer Work in Medical Sciences.—Graduate courses in medical sciences are offered in the summer quarter between June and September at the College of Medicine of the University of Illinois in Chicago. Circulars describing the courses offered and conditions of admission and work may be obtained from the Secretary of the College of Medicine, Congress and Honore Streets, Chicago.

Failures.—A graduate student who fails in any course in his major subject cannot secure his degree in the same year in which the failure occurred. No condition examinations are given graduate students.

Withdrawal.—If after registration a graduate student wishes to withdraw from any course or to add other work, he must first secure the necessary papers from the Dean's office. See the regulations concerning changes in study lists, page 10. If he wishes to withdraw from the University he must get clearance papers at the Dean's office.

DEGREES

Masters' Degrees

Character of Masters' Degrees.—The master's degree conferred depends upon the character of the bachelor's degree. The usual practise is that A.M. shall follow A.B., that M.S. shall follow B.S. However, this practise may be departed from in cases where the undergraduate course of study of the candidate was of a kind for which some reputable institutions in this country give A.B., while others give B.S. Such departure from the regular practise is permitted, however, only on individual petition duly approved.

Amount of Work Required.—Candidates for the degree of Master of Arts or Master of Science are required to do at least one full year's work in residence, including a thesis. By this is meant from four to five unit courses each semester, or their equivalent. A unit course is one which requires ten

hours of time a week through one semester, or a minimum of 180 hours, irrespective of the mode of distribution of that time in class work, laboratory work and private study. Four such courses or their equivalent constitute a full *minimum* program for one semester, and eight such courses, or their equivalent, constitute the *minimum formal* year's work accepted for a master's degree. Only first rate students are permitted to secure a degree with this minimum program.

Unless otherwise permitted, on individual petition duly approved, every student must take each semester at least one course open to graduate students only (courses numbered 100 and upwards).

In the first year of his graduate study each student is required to attend a minimum of four formal class, lecture, or laboratory exercises a week. In no case is he permitted during his course to attend more than twelve a week, without permission.

Work Done Elsewhere.—Exception is made to the requirement that all work for the master's degree must be done in residence at the University in the case of members of the staff and high school teachers residing and employed in Urbana or Champaign who have spent half of their time in graduate study through a year at some other approved institution. They may complete the requirements for the master's degree in a year of residence here, spending half their time in study. The candidates must take examinations in the work done elsewhere as well as in that done at this university.

Majors and Minors.—A candidate for a master's degree may do all his work in one subject, or he may select a major and one minor, or a major and two minors. A major or minor denotes the field of knowledge of a department, or such part thereof as constitutes a separate and independent division of that field. For a master's degree a major is at least half the work, or a minimum of four units, for one year. Less than one unit may not be counted as satisfying the requirements of a minor without the approval of the department concerned.

A program of studies for a first-year graduate student which is limited exclusively to the investigation of a single problem will not be approved.

Foreign Language.—The ability to use one or more of the modern languages ordinarily studied in the undergraduate curriculum is expected of all candidates for the master's degree, and in some lines of study is required. On this matter students should consult the heads of the departments in which their major subjects lie.

Master's Thesis.—Each candidate for a master's degree is required to present a thesis on some subject approved by the professor in charge of his major work and the Executive Faculty of the Graduate School. The requirement of a thesis may be waived, however, upon the recommendation of the head of the department in which the student is doing his major work and the approval of the Dean, provided application to waive the thesis is made at the beginning of the year. *In no case will permission to take the degree without the thesis be given by the Dean if applied for later than the latest date for the approval of thesis subjects, as shown by the calendar.* A student excused from writing a thesis must replace it with additional courses of instruction.

No one will be excused from writing a thesis unless one-half of his program of studies consists of courses numbered 100 and upwards.

Students working for their masters' degrees in the summer session must announce their thesis subjects not later than the beginning of their third session in residence.

Students who expect to take their masters' degrees in October and February must announce their thesis subjects not later than two months after their first enrollment.

The thesis required from a candidate for a master's degree ordinarily will demand one-fourth of the student's time and may not exceed one-third of it. The thesis must be typewritten, on "thesis paper,"* and the title page must be printed. The thesis in its final form, together with a certificate of approval by the proper officer, must be left by the professor in charge at the Dean's office at the time set in the calendar. No article prepared for another use, or previously published, will be accepted as a thesis.

Thesis Work on Leave of Absence.—Under proper conditions a student may be permitted to complete the last fourth of his work, if devoted to his thesis, under leave of absence. To get such permission the student must have secured credit for at least six units; must petition for the privilege; must submit to the Dean an outline of the proposed investigation, approved by the head of his major department; and must submit satisfactory evidence that adequate facilities are available to him at the place where he intends to do the proposed work. Approval on all these points must be obtained one collegiate year before the thesis is due.

Grades.—Student's work is graded in five classes, A, B, C, D and E. The last indicates a failure. D indicates unsatisfactory, though passable, work. The degree will not be awarded to any student who does not secure a grade of B or higher in three-fourths of the work (number of units) for the degree, including his thesis.

A failure or absence from examination in any course may prevent the conferring of the degree; and, as already indicated, failure in any course in the major field precludes the conferring of the degree in the same year.

Marine Biological Laboratories.—Students in zoology, candidates for the master's degree, part of whose necessary preparation is experience in a marine or fresh-water biological laboratory or station, are permitted to offer, in part fulfillment of the requirements for the master's degree, work done in such fresh-water or marine laboratory; provided that the student who wishes to have such work accepted make application before beginning work in such laboratory; that the selection of the laboratory at which he is to work has been approved by the faculty beforehand; that the time to be spent in such work be not less than six nor more than nine weeks in any one summer; that the instructors under whom the student is to work have been previously accepted by this faculty; that he submit to an examination here on the work done at such laboratory; and that a certificate of attendance from a proper officer of the laboratory or station be submitted and a full written report of the work

*No other will be accepted by the Dean. "Instructions for the preparation of theses" may be obtained at the Dean's office.

done in the shape of notes, or otherwise, be required; and that the student shall be in residence here at the University for one full academic year during which he shall do the rest of the work necessary for his degree.

The marine biological laboratories which have thus far been approved as institutions at which students of this University may take work for record here are:

Marine Stations:

Marine Biological Laboratory, Woods Hole, Massachusetts
Harpswell Marine Laboratory, Casco Bay, Maine
Puget Sound Station, Friday Harbor, Washington
Hopkins Marine Laboratory of Stanford University, Pacific Grove, California
Scripps Institute for Biological Research, University of California, LaJolla, California
Carnegie Institution Laboratory, Dry Tortugas, Florida
Bermuda Biological Station, Bermuda
Brooklyn Institute Biological Laboratory, Cold Spring Harbor, L. I.

Fresh-Water Stations:

Douglas Lake Station, University of Michigan, Topinabee, Michigan
Ohio State University Laboratory, Cedar Point, Ohio
University of Wisconsin Lake Laboratory, Madison, Wisconsin.

Similar arrangements are made, under similar conditions, for students of geology in connection with Geological Surveys.

MASTERS' DEGREES IN ENGINEERING

Two classes of second degrees are open to graduates of the College of Engineering, namely, academic and professional.

The academic second degree in engineering is Master of Science, following Bachelor of Science, in architecture, architectural engineering, civil engineering, electrical engineering, etc. This degree is conferred in accordance with the regulations described above for *academic work in residence only.*

The *professional* second degrees in engineering are as follows:

Master of Architecture, after B.S. in architecture.

Architectural Engineer, after B.S. in architectural engineering.

Civil Engineer, after B.S. in civil engineering or B.S. in municipal and sanitary engineering.

Electrical Engineer, after B.S. in electrical engineering.

Mechanical Engineer, after B.S. in mechanical engineering.

Engineer of Mines, Civil Engineer, Electrical Engineer, or Mechanical Engineer, after B.S. in mining or railway engineering, according to the course.

Professional degrees are conferred on two classes of candidates: (1) graduates of the College of Engineering of the University of Illinois who have been engaged in acceptable professional work away from the University for a period of not less than three years after receiving the degree of Bachelor of Science; (2) graduates of the University of Illinois, or of institutions of equal standing who have been engaged in acceptable professional work in residence at the University for a period of not less than three years after receiving the degree of Bachelor of Science.

In "acceptable professional work" may be included contributions to technical literature, activity in professional societies, investigation of engineering problems, and the teaching of engineering subjects.

A candidate must declare his candidacy and file with the Dean of the College of Engineering, as chairman of the committee in charge, a detailed statement covering his professional study and experience, not later than the first Monday in November preceding the commencement at which he proposes to qualify. Prior to December 31 next succeeding, he must submit for approval an outline of his proposed thesis and he must file his completed thesis not later than April 1. If the statement of professional experience and study and the thesis are accepted, the candidate must present himself at commencement in order to receive the degree.

Candidates for professional engineering degrees who already hold the degree of Master of Science may qualify for the professional degree after two years of professional work.

A candidate for a professional engineering degree must pay the incidental fee of thirty dollars on being notified that his professional study and experience are accepted as qualifying him to enter as a candidate for the degree. No one will be enrolled as a candidate for the degree at the following commencement who does not pay his fee at this time. When a candidate for a professional engineering degree has once been accepted and paid his fee, he is eligible to receive the degree at any time within five years, without additional fee, on completion of the requirements; provided, however, that unless he completes the requirements within two years his name will be dropped from the list of candidates and in order to receive the degree within the five-year period he must register once more.

THE DEGREE OF DOCTOR OF PHILOSOPHY

Majors and Minors.—The requirements for the degree of Doctor of Philosophy are a thoro mastery of a selected field of study, evidence of the power of independent investigation in this field, a broad knowledge of the wider field of study of which this major subject is a part, a general acquaintance with related fields of knowledge, and a mastery of all branches of study which are necessary to a full knowledge of the main subject. Each student who is seeking this degree is expected to choose for study and final examination a major subject, or field of study, and a first and second minor. The major subject is the field in which the student expects to become expert and an authority. The first minor must be a subject closely related to the major, and may, under certain conditions and with proper approval, be a subdivision of the major field of study. The second minor should be chosen outside of the major field of study, and must be so chosen by a candidate who elects a division of his major field for his first minor.

For the doctor's degree no definite division of a student's time among major and minors can be made, to hold in all cases., In general the faculty approves an arrangement which, distributing the student's time through the required three years, divides it equally among his three subjects in his first year of graduate study; in the proportion of two to one, as between his major

and first minor, in the second year of graduate study (his second minor being finished and dropped at the end of the first year); and gives all his time to his major during his third year.

To put the matter in another way, a course of graduate grade (from among the "hundred" courses) meeting twice or three times a week, corresponding roughly to what is sometimes called a full course, or in our terminology a unit course, running through the year, should ordinarily be sufficient for a second minor; a similar course running through two years should ordinarily be sufficient for a first minor.

While "full-time work" in the first year of graduate study, leading usually to a master's degree, is at least eight units for the two semesters, full-time work after the first year is not reckoned in units. The student is simply required to devote all his time to his work. Nor is there any necessary correspondence between the number of courses taken and the number of units required in the first year, or full-time work in any year. A first-year student might possibly secure all the credit necessary in two or three courses; and a second-year or third-year student might conceivably be devoting all his time to one course and his research or to his research alone.

Period of Study.—The *minimum* period of study required for securing the degree of Doctor of Philosophy is three years, during which the student is required to devote all his working time to his studies. All three years must be spent in residence at some accredited educational institution and either the first two or the last one of the three must be spent at the University of Illinois. The degree is conferred, however, not for residence during a certain period, but for scholarly attainments and power of investigation, as proved by thesis and examinations.

Credit for work done in other universities is not "transferred." The candidate is examined here on the subjects offered by him for the advanced degree. However, his period of residence at another institution of proper grade may be accepted in fulfillment of the residence requirement of the University of Illinois, so far as it goes.

Preliminary Examination.—Towards the end of his second year of study, or, by special permission, at the beginning of his third year, the candidate for the degree must submit to a preliminary examination, in order to determine whether he will be accepted as a candidate for the degree in the following year. This examination is intended to test the student's knowledge of the fields of his major and minor subjects of study only. It is partly oral, and may be wholly so.

The student will not be admitted to his preliminary examination until the faculty is satisfied that he has finished substantially the equivalent of two years' graduate work. He must do a full year's graduate work between his preliminary examination and the completion of his work for the doctorate.

Language Examination.—The candidate will be required to demonstrate his ability to read French and German and other languages needed in his work. This test of proficiency in the use of French and German takes place not later than the time of the preliminary examination for admission to candidacy.

Final Examination.—On or before the last Monday in May of the year in which the candidate expects to come up for his degree, he must submit to a final examination, given by a committee appointed by the Dean. This examination is primarily on the research work of the student, as embodied in his thesis, but it is not confined to that. It extends to the whole field of the study of the candidate. It will not be confined to the courses which the candidate has attended in the University of Illinois only, if he has done part of the work elsewhere; nor even to the field covered by the courses specifically taken in this or other universities; but will be so conducted as to determine whether the candidate has a satisfactory grasp of his major subject as a whole, and a general acquaintance with the fields of knowledge represented by his course of study.

The final examination may not be divided. The examination must be taken all at one time even tho it requires several sessions.

Other Examinations.—Before the candidate is admitted to the final examination and the defense of his thesis, he may be required to take any other examination, oral or written, that is thought proper by the various departments in which he has studied. If, after having passed his preliminary examination, he fails in the third year of his study to meet the expectations of the professors in charge of his work, or in any way fails to maintain the standard of scholarship and power of research expected of him, he may be refused admission to the final examination.

The above examinations are in addition to those in the courses for which the student is registered. These must be taken at the times for which they are set in the examination schedule.

No candidate who does not secure a record of B or higher in at least three-fourths of his work will be recommended for the degree.

Thesis.—The power of independent research must be shown by the production of a thesis on some topic connected with the major subject of study. The candidate is expected to defend his thesis or dissertation before the members of the faculty, or as many of them as may wish to question him about it, in connection with his final examination.

The subject of the thesis should be chosen not later than the end of the second year of study and must be submitted for formal approval by the faculty not later than the first Monday of November of the year when the degree is expected.

Unless previously printed with proper authority, a typewritten copy of the complete thesis, *on thesis paper,** must be deposited in the office of the Dean for presentation to the examining committee not later than two weeks prior to the final examination. All theses must be in the hands of the Dean by noon of the Saturday nearest the middle of May.

The doctor's thesis must be printed and one hundred copies deposited in the Library of the University by the candidate, not later than the first of June preceding the conferring of the degree. In form, the printed thesis must follow the "instructions for the preparation of masters' and doctors' theses," copies of which may be obtained at the Dean's office on application. If it is not

*No other will be accepted by the Dean.

printed by the first of June, the student must, not later than that date, deposit seventy-five dollars ($75) or a bond for that amount satisfactory to the Comptroller of the University and the Dean of the Graduate School. A member of the faculty of the University of Illinois will not be accepted as a guarantor on such a bond. If a bond is accepted, it must be replaced at the end of one year with a cash deposit. At the end of two years, if the thesis has not then been printed by the student, the University will print it or such part of it as is deemed best.

The cash deposit made by the student who does not print his thesis by the end of the second year after his degree is conferred becomes the property of the University, to be used for the general purpose of printing theses.

The title-page of each thesis, whether typewritten or printed, must bear the words, "Submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in—[here put the major subject]—in the Graduate School of the University of Illinois." The title-page must also contain the full name of the author, his previous degrees, the full title of the thesis, the year of imprint and, if a reprint, the title and volume and a statement of the pagination of the volume from which it is reprinted. Each thesis must have an appendix giving a short biography of the candidate, including the institutions he has attended, his degrees and honors, the titles of his publications, and such other matters as are pertinent.

Doctor's Degree in Engineering.—The degree of Doctor of Philosophy in Engineering is offered in certain lines of academic work of a high scholastic type in engineering science for students who wish to prepare themselves as teachers, investigators, and experts.

The general requirements for this degree, as to preliminary education, linguistic attainments, etc., are the same as in other lines.

The following lines of engineering science are open as majors:

Engineering mechanics
Steam engineering
Hydraulic and sanitary engineering
Electrical engineering
Heating and ventilation engineering
Railway engineering
Masonry construction and structural engineering
Coal-mining engineering

The first minor may be any of the above or one of the following fundamental sciences or an authorized combination of two of them:

Theoretical mechanics
Mathematics
Thermodynamics
Chemistry
Geology
Physics (Experimental or mathematical)
Zoology
Botany

The second minor should be in other than engineering subjects.

SCHOLARSHIPS AND FELLOWSHIPS

A number of scholarships and fellowships have been established by the Trustees of the University. To first-year graduate students of ability and promise there are open a number of scholarships with a stipend of $300 each and freedom from tuition, incidental, and laboratory fees.* To second-year and third-year graduate students, that is, those who have had one or two years of graduate study, there are open fellowships with a stipend varying from $350 to $500, with freedom from the above-mentioned fees. The larger stipends are given only to students who are expected to take their degrees within the year. Each holder of a fellowship or scholarship must pay the matriculation fee of ten dollars, unless he holds a first degree from the University of Illinois, and also the diploma fee of ten dollars on receiving his diploma.

Candidates for these scholarships and fellowships must be graduates of the University of Illinois, or of colleges or universities having equivalent requirements for bachelors' degrees.

Application must be made on blanks to be obtained from the Dean of the Graduate School. These application forms should be sent to the Dean of the Graduate School as early as possible in February of the academic year preceding that for which the fellowship is desired. No application will be considered if received later than March first, until after April fifteenth, the date when appointees from the first list of applicants must accept or refuse their appointments.

Persons appointed are notified on April first and must send the Secretary of the Board of Trustees notice of their acceptance or refusal by April fifteenth; and must agree that, if accepted, the appointment will not be resigned to take a similar one in any other institution during the year for which it is awarded.

Nominations to fellowships are made on the grounds of worthiness of character, scholastic attainments, and promise of success in the principal line of study or research to which the candidate proposes to devote himself. Scholarships and fellowships are not given to candidates who are over thirty years of age at the time when the appointment is to be made.

For second-year fellowships, adequate preparation in French, and for third-year fellowships, adequate preparation in French and German is required.

An appointment as honorary fellow, without stipend, may be made as specified for paid fellowships in the case of any one who has shown distinguished merit in his work.

LIBRARIES

The general University library, the library of the State Laboratory of Natural History, that of the State Geological Survey, and that of the College of Law are all at the University in Urbana. The libraries of the School of Pharmacy and the College of Medicine are in Chicago.

These libraries contain 461,598 volumes, and 54,615 pamphlets. Of these, 436,376 books and 51,056 pamphlets are in the libraries at Urbana; the rest are in Chicago. The library at Urbana also contains 2,128 maps and 5,192 pieces of sheet music. The departments at Urbana currently receive about 6,000 serials, while the College of Medicine and School of Pharmacy in Chicago receive 250.

* Up to a certain amount.

The general library of the University is open daily, from 8 a. m. until 10 p. m. and on Sunday from 2 p. m. to 6 p. m.

The Mason Historical Library.—The library of western history collected by Edward G. Mason, Esq., long President of the Chicago Historical Society, is in the public library of the city of Champaign, and is accessible to University students.

The Dittenberger Classical Library.—The University possesses the library of Wilhelm Dittenberger, at one time Professor of Classical Philology in the University of Halle. This library contains 5,600 items. It includes the works of the poets and prose writers, numerous works on grammar and history of literature, and between four and five thousand dissertations and programs on special topics. There are also many works dealing with other departments of classical philology, as epigraphy, history of ancient peoples, archeology, philosophy, history of art, geography, chronology, metrics, etc.

The Heyne Library of Germanics.—The library of Professor Moritz Heyne of the University of Göttingen was bought by the University. It contains about 5,200 volumes. The collection is rich in the general field of German philology and in lexicography. It has many rare first editions of works of German literature from the sixteenth, seventeenth, and eighteenth centuries and has sets of a number of rare periodicals.

The Gröber Library in Romance Languages.—The University also possesses the library of Professor Gröber of the University of Strassburg. This library contains about 6,500 titles.

The Vahlen Library, of the late Johannes Vahlen, contains about 10,000 volumes and is in itself an excellent working library in classical philological literature. It is well supplied with texts of Greek and Latin authors.

The Aron Library, collected by the late teacher and student of pedagogy, R. Aron, contains about 20,000 volumes. It is a scholarly collection of educational documents, among them many original and early editions, and furnishes firsthand material for the study of educational movements in Europe, especially in Germany, from the time of Luther and Comenius to the present. The collection of German "Fibeln" or school readers is unique, and the material for the history of juvenile songs and literature, the set of 17th and 18th century atlases, and the collection of rare hymn books and juvenilia make the collection very useful to students of education.

FEES AND EXPENSES

Except as noted below, graduate students pay fees as follows:

Matriculation fee	$10.00
Incidental fee, each semester	25.00
Diploma fee	10.00
For late registration	1.00
For change in study-lists	1.00

All graduate students who have not matriculated as undergraduates at the University of Illinois pay the matriculation fee on entrance.

All graduate students pay the diploma fee.

No tuition or incidental fee is charged for graduate courses to scholars, fellows, or members of the corps of instruction or the staffs of the University libraries or of the scientific bureaus or experiment stations, who are appointed by the Board of Trustees, nor for undergraduate courses on their study-lists if approved by the heads of the departments and by the Dean of the School as necessary or desirable for the proper completion of the work for the degree. Otherwise graduate students who take undergraduate courses must pay the proper undergraduate fee.

Each student working in the laboratories, or in the drafting or engineering classes, is required to make a deposit of from 50 cents to $10.00, to pay for chemicals and apparatus used, and for any breakage or damages. But no charges or deposits for laboratory materials are required from scholars, fellows, or members of the corps of instruction or scientific staffs mentioned above, except when breakage or consumption of materials exceeds a certain allowance.

Table board may be obtained at prices ranging from $7 a week.

Room rent, single room, ranges from $15 a month; double room, $10 a month, each person.

THE GRADUATE CLUB

The Graduate Club is an unofficial organization of the graduate students and faculty. Its purpose is to furnish an opportunity for those working in different departments to become acquainted with one another and thus counteract the tendency toward narrowness which intense specialization may sometimes induce.

DEPARTMENTS OF INSTRUCTION

Courses open to graduate students are of two classes. The first class is wholly of graduate grade, and the courses are numbered 100 upwards. The second class includes the courses classified as for graduates and advanced undergraduates. These carry numbers below 100. The courses numbered 100 and upwards are all accepted for major credit. Those of the other group are in many cases accepted for minor credit only. This is especially true of courses which are open to juniors.

All courses have certain prerequisites for admission. Inasmuch as the prerequisite preparation may be gained at other institutions from courses differing from those offering a similar preparation at the University of Illinois, so that a statement of prerequisites as given here would not be understood elsewhere, their description is omitted altogether. However, a student who wishes to enter a particular course must satisfy the department concerned that he has had in some form the prerequisites for admission to the course.

For the convenience of first-year students the credit value of graduate courses is given in units. These values have no significance for second-year and third-year students.

The credit received for "courses for graduates and advanced undergraduates" is in accordance with the regulations of the Graduate School circular, page 10.

Students are admitted to graduate standing in agriculture who have had a thoro training in the sciences underlying agriculture, and who are otherwise eligible to the Graduate School, even tho their undergraduate course of study lacked to some extent the amount and kind of technical work in agriculture included in the course of study for the bachelor's degree in agriculture at the University of Illinois.

ACCOUNTANCY

These courses may be taken for second minor credit only. They may be chosen only by students who have had at least two years' previous training in accountancy and whose major subject is economics (including commerce), business organization, railway administration, engineering, or agriculture.

Courses for Graduates and Advanced Undergraduates

3a-3b. Advanced Accounting and Auditing.—Must be taken throughout the year in order to secure credit. *Three times a week; both semesters.*

Professor Scovill

4a. Cost Accounting.—(a) Cost accounting applied to factory procedure, overhead expense, the installation and control of cost systems, presentation of cost data; (b) as a basis for manufacturing efficiency; (c) the construction of cost systems. *Twice a week; first semester.*

Assistant Professor Littleton

4b. Accounting Systems. — Systems of various mercantile establishments and specialized businesses as banks, building and loan associations, insurance companies, brokers, and the several types of public utility corporations. *Twice a week; second semester.*

Professor Scovill

5a-5b. C. P. A. Problems.—Representative problems of various types, including questions on theory of accounts and auditing. The second semester may not be taken without the first. *Twice a week; both semesters.*

Professor Scovill

13a-13b. Governmental Accounting.—*Twice a week; both semesters.*

Assistant Professor Morey

20. Income Tax Procedure.—Application of the requirements of the Federal income, excess-profits and war-profits taxes. *Twice a week; second semester.* Assistant Professor Filbey

AGRONOMY

Students taking their major work in Agronomy must have had the major courses in Agronomy offered to undergraduates in the College of Agriculture of the University of Illinois, or their equivalent. Graduate students may specialize either in soils or in crops. Courses 7, 11, and 12, or the equivalent, will be required of graduates who specialize in soils and Courses 7, 12, and 22, or the equivalent, will be required of those specializing in crops. While everyone seeking a doctor's degree with Agronomy as a major will be required to have a general knowledge of the whole field of Agronomy, each student is expected to prepare a thesis in some one of the divisions, soil fertility, soil physics, soil biology, plant breeding, crop production, or farm mechanics.

Students who are taking their major work in other departments and choose Agronomy as a minor, must have had previously the work in chemistry, botany, and other fundamental sciences prescribed for the undergraduate course in Agronomy in the College of Agriculture, or the equivalent.

Courses for Graduates

101. Soil Investigations.—Systems of soil investigation; sources of error and methods of control; interpretation of results. *Twice a week; both semesters. One unit.* Assistant Professor DeTurk

104. Seminar in Agronomy.—*Once a week; both semesters. One-half unit.* Professor Whiting and others

112. Plant Breeding.—Experiments at this station; methods and results reported from other states and from foreign countries. *Twice a week; both semesters. One-half to two units.* Professor L. H. Smith

114. Crop Production—Crop ecology; methods and results of crop production investigations. *Once a week; both semesters. One-half to two units.*

Professor Burlison

118. Investigation.—A special problem is chosen by each student. Consultation one to five times a week for different students; both semesters. *One to four units.*

Professors L. H. Smith, Mosier, Burlison, Whiting and Assistant Professors DeTurk and R. S. Smith

Courses for Graduates and Advanced Undergraduates

7. **Advanced Farm Crops.**—Climatic and soil factors; rotation; distribution of labor; cost of production; pure seed production; supply and consumption of products and by-products; storage and marketing. *Three times a week; second semester.* Professor BURLISON

10. **Soil Physics.**—The problems, methods and literature of soil physics are treated in lectures; laboratory work, if taken, is arranged to meet the needs of each student. *Lectures twice a week; laboratory one to three times a week; second semester.* Assistant Professor R. S. SMITH

11. **Soil Biology.**—Biochemical activities of soil microorganisms in relation to soil fertility. *Five times a week; second semester.* Professor WHITING

12a. **Soil Fertility, Fertilizers, Rotations.**—The influence of fertility; effect of different crops on the soil and on succeeding crops. *Twice a week; second semester.* Assistant Professor DETURK

22. **Plant Breeding.**—Improvement of field crops, selection. *Twice a week; second semester.* Professor L. H. SMITH

23. **Plant Food Supplies.**—The world's supply of plant food materials; utilization and conservation. *Twice a week; second semester.* (Not given, 1920-21.) Assistant Professor DETURK

ANIMAL HUSBANDRY

Students entering graduate work in animal husbandry must have had a thoro training in the fundamental principles of the subject either in connection with or in addition to a course of study in agriculture substantially equivalent to that offered in this University.

Courses for Graduates

103. **Live Stock Experimentation.**—Objects, methods, and the sources of error in experimental work dealing with the feeding, breeding, and management of farm animals. *Once a week; second semester. One-half unit.* Professor DAVENPORT

110. **Animal Nutrition.**—Biochemistry, digestion, metabolism, and nutritive value of proteins. *Twice a week; both semesters. One unit.* (Not given, 1920-21.) Professor GRINDLEY, Assistant Professor MITCHELL

111. **Animal Nutrition.**—Biochemistry, digestion, metabolism and nutritive value of fats and liquids, carbohydrates, and inorganic substances. *Twice a week; both semesters. One unit.* Professor GRINDLEY, Assistant Professor MITCHELL

112. **Research.**—Investigations along the following lines:

(a) Economic factors involved in meat production. Professor MUMFORD, Professor COFFEY, Professor RUSK

(b) Systems of live stock farming. Professor HANDSCHIN

(c) The valuation of pedigrees. (Not given, 1920-21.)

(d) Animal nutrition. The chemistry of feeding stuffs; metabolism experiments and biochemical studies connected with the nutrition of farm animals.
Professor GRINDLEY, Assistant Professor MITCHELL

(e) Genetics. Problems in heredity and variation. Professor DETLEFSEN

(f) Factors affecting the quality, quantity, strength, and condition of wool.
Professor COFFEY

(a), (b), (c), and (f), one to three times, (d) and (e), five times a week; both semesters. One to two units. These courses may be taken during the summer by special permission.

116. Seminar in Animal Husbandry.— *Once in two weeks; both semesters.* Members of the department

117. Genetics. — Genetic experiments; biological and mathematical methods employed; the validity of the conclusions. *Two to five times a week; both semesters. One to two units.* Professor DETLEFSEN

Courses for Graduates and Advanced Undergraduates

7. Principles of Animal Nutrition.—*Five times a week; first semester.*
Assistant Professor MITCHELL

22. Advanced Stock Judging.—Animal conformation with reference to market and show yard form; quality and condition. *Five times a week; first semester.* Various members of the department

24. Meat.—Influence of type, condition, age, sex, and feeds on the yield and market grade of meat products. *Once a week; second semester.* (Not given, 1920-21.) Professor COFFEY

26. Swine.—The economical production of pork. Problems and methods. *Once a week; second semester.* Mr. RICE

27. Sheep Husbandry.—The industry in leading sheep growing countries and particularly in different parts of the United States. *Once a week; second semester.* (Not given, 1920-21.) Professor COFFEY

28. Advanced History of Breeds of Live Stock.—Methods of prominent breeders, and performances of great individual animals: beef, horses, sheep, and swine. *Once a week; first semester.*
Professor COFFEY and other members of the department

29. Systems of Live Stock Farming.—Farm management applied to live stock farming. *Twice a week; second semester.* (Not given, 1920-21.)

30. Genetics.—Heredity and variation. *Daily; second semester.*
Professor DETLEFSEN

31. Advanced Course in Animal Nutrition.—Digestion; histology and composition of body tissues; metabolism of food nutrients; effect of food nutrients on metabolism; the fasting catabolism; food requirements and feeding standards; growth; nutritive value of proteins and amino acids. *Five times a week; second semester.* Assistant Professor MITCHELL

32. Marketing Live Stock.—*Twice a week; second semester.*
Associate Professor GUSLER

ARCHITECTURE AND ARCHITECTURAL ENGINEERING

The prerequisite for graduate work in architecture and architectural engineering is the equivalent of the undergraduate courses required at the University of Illinois for the degree of Bachelor of Science in architecture and architectural engineering in the branches of the subjects in which registration is desired.

Courses for Graduates

101. Architectural Construction.—Design of special structures. *Twice a week; both semesters. One-half to one unit.*
Professor Ricker and Professor Provine

103. Advanced Architectural Graphics.—*Twice a week; both semesters. One to two units.* Professor Provine

104. Architectural Design.—Advanced course. *Twice a week; both semesters. One to four units.* Associate Professor ————

105. Architectural Practise.—Contracts, specifications, and office methods. *Twice a week; first semester. One-quarter to one-half unit.*
Professor Provine

ASTRONOMY

The prerequisites for graduate study in astronomy are mathematics through the calculus, a year's course in observational astronomy, and a course in college physics.

Courses for Graduates

101. Seminar.—*Three times a week; both semesters. One unit.*
Professor Stebbins

102. Stellar Astronomy.—Orbits of binary stars; variable stars; theoretical photometry. *Three times a week; both semesters. One unit.*
Professor Stebbins

Courses for Graduates and Advanced Undergraduates

7-8. Theoretical Astronomy.—Celestial mechanics; theory of orbits. *Three times a week; both semesters. One unit.* Professor Stebbins

14. Observational Astronomy.—The working methods of an astronomical observatory. *Three times a week; second semester. One unit.*
Professor Stebbins

15. Geodetic Astronomy.—The sextant, transit, and zenith telescope; methods similar to those of the United States Coast Survey. *Three times a week; first semester. One unit.* Professor Stebbins

BACTERIOLOGY

Instruction in bacteriology is offered by the departments of agronomy, botany, chemistry, and dairy husbandry. The work is offered under the supervision of a committee representing these departments.

Students who take a major in bacteriology must have had 10 semester hours of bacteriology and 15 semester hours of chemistry. The thesis may be chosen

in any one of the following fields: general bacteriology, bacteriology of the dairy, of soils, of water and sewage, of animal diseases, or of plant diseases.

Candidates for the doctor's degree, with a major in bacteriology, will be held responsible for a general knowledge of all of the above mentioned fields in bacteriology.

A candidate for the doctor's degree, with a major in some field other than bacteriology, who elects a first or second minor in bacteriology must offer a minimum of four units for the first minor and a minimum of three units for the second minor selected from the courses listed below.

Courses for Graduates

Bacteriology

103. Physiology of Bacteria.—Fermentation; growth and death of bacteria. *Once a week; first semester. One unit.* Assistant Professor TANNER

105. Classification of Bacteria.—Variability of species; characters; mutations; standard and biometrical classification. *Once a week; second semester. One unit.* Assistant Professor TANNER

107. Research—(For those students who are taking a major in bacteriology either for the doctor's degree or the master's degree. Thesis work may be taken in any of the fields indicated below.) *Once a week; both semesters. One-half unit to four units.*

General Bacteriology	Assistant Professor TANNER
Dairy Bacteriology	Professor HARDING
Pathogenic Bacteriology	Assistant Professor TANNER
Plant Pathology	Professor STEVENS
Water and Sewage Bacteriology	Professor ————

Agronomy

118. Investigations in Soil Biology.—Special problems. *Consultation one to five times a week for different students; both semesters. One to four units.* Professor WHITING

Chemistry

110. Water Supplies.—Sources of contamination of water supplies; purification of water for potable or technical use. *One to five times a week; both semesters. One-half to one and one-half units.* Professor ————

Dairy Husbandry

104. Scientific Readings.—Discussion of bacteriological problems based on selected German or French texts. (Recommended for first and second year students.) *Once a week; both semesters. One-half unit.*

Professor HARDING, Associate Professor PRUCHA

105. **Bacteriological Literature.**—Each student is required to prepare and deliver an acceptable course of lectures. (Recommended for second year and third year students.) *Once a week or once in two weeks; both semesters. One-half or one unit.* Professor HARDING

106. **Research on Assigned Problems.** — Open to graduate students whose development permits their undertaking problems of dairy bacteriology with only general supervision. *Once a week; both semesters. One-half unit to two units.* Professor HARDING, Associate Professor PRUCHA

Courses for Graduates and Advanced Undergraduates

Bacteriology

8. **Applied Bacteriology.**—Water, sewage, and food bacteria. *Five times a week; second semester.* Assistant Professor TANNER

Botany

18a-18b. **Journal Meeting.**—Required of all students majoring in general and pathological bacteriology. *Once a week; both semesters.* Assistant Professor TANNER

20. **General Bacteriology.**—For seniors and graduate students who do not take bacteriology as a major. Assigned readings in foreign literature. *Five times a week; first semester.* Assistant Professor TANNER

26. **Pathological Bacteriology.**—Cultural and morphological characteristics of disease-producing organisms; immunity and serum reactions; routine diagnostic procedure. *Three times a week; first semester.* Assistant Professor TANNER

Agronomy

11. **Soil Biology.**—Biochemical activities of soil microorganisms in relation to soil fertility. *Five times a week; second semester.* Professor WHITING

Botany

22a. **Morbid Histology.**—Histology of the plant tissues; parasites in condition of disease. *Once a week; first semester.* Professor STEVENS

22b. **Bacterial Plant Diseases.**—*Once a week; second semester.* Professor STEVENS

Chemistry

10a. **Study of Water Supplies.**—History, sources, contamination, and standards of purity of potable waters and waters for industrial purposes; analytical methods. *Three times a week; second semester.* Professor ———

Dairy Husbandry

10. **Dairy Bacteriology.**—Study of some of the more important relations of bacteria to milk and its products. Lectures; laboratory. *Three times a week; second semester.* Associate Professor PRUCHA

11. **Dairy Bacteriology.**—Bacteria in milk and its products; sources, effect on milk, and method of control. *Twice a week; first semester.* (Not given, 1920-21.) Professor HARDING

12a-12b.—Dairy Bacteriology.—Laboratory work supplementing Dairy Husbandry 11. *Four times a week; both semesters.* (Not given, 1920-21.)
Professor HARDING

BOTANY

Candidates for advanced degrees in botany must offer for admission at least 20 hours in university botany, or 15 hours in botany and 5 hours in zoology or in entomology.

Graduate students who desire to elect botany for minor credit must offer the equivalent of 10 hours in university botany as well as any other stated prerequisites to the courses selected.

Courses for Graduates

101. Individual Plant Development. — Origin of the individual; external and internal factors in its development and physiologic performance; response of the cell, somatic and generative, to external factors. *Once a week; both semesters. One-half to two units.* Professor HOTTES

102. Physiology.—Effects of external stimuli on growth and movement. *Once a week; both semesters. One-half to two units.* Professor HOTTES

104. Mycology.—Field and laboratory investigation of selected groups of fungi. *Once a week; both semesters. One-half to two units.*
Professor STEVENS

106. Plant Pathology.—Diseases of plants, and disease agents. *Once a week; both semesters. One-half to two units.* Professor STEVENS

107. History of Botany.—A conference course with reading and lectures. *Once a week; first semester. One-half unit.* Professor TRELEASE

108. Taxonomy.—Monographic studies of critical groups. *Once a week; both semesters. One-half to two units.* Professor TRELEASE

109. Ecology.—The interrelation of plants and their environment. *Once a week; both semesters. One-half to two units.*
Assistant Professor MCDOUGALL

110. Current Botanical Literature.—*Once a week; both semesters. One-quarter unit.* The Staff

Courses for Graduates and Advanced Undergraduates

7b. Methods in the Study of Fungi.—Isolation, cultivation, and inoculation of fungi and bacteria. *Once a week; second semester.*
Professor STEVENS

9a-9b. Plant Anatomy or Physiology.—Problems to meet the needs of individual students. *Once a week; both semesters.* Professor HOTTES

14. Heredity, Variation, Evolution.—Cells and members of plants; adaptations and changes; mechanism of heredity; evolution. *Twice a week; second semester.* (Offered for 1922-23, and in alternate years.)
Professor HOTTES

16b. Taxonomy and Morphology of Algae and Bryophytes.—Advanced practise on selected groups. *Once a week; second semester.* Dr. HAGUE

17a-17b. Taxonomy of Cormophytes.—Advanced practise on selected taxonomic or economic groups. Specialized studies, as of genera or families of Illinois plants. *Once a week; both semesters.* Professor TRELEASE

22a. Morbid Histology.—Histology of plant tissues; parasites in condition of disease. *Once a week; first semester.* Professor STEVENS

22b. Studies of Special Groups of Fungi or Diseases of Special Crops or Groups of Crops.—*Once a week; second semester.* Professor STEVENS

25a-25b. Plant Ecology.—The ecology of plants or of plant communities. *Once a week; both semesters.* Assistant Professor MCDOUGALL

26. Taxonomy and Ecology of Higher Fungi.—Advanced practise on selected groups. *Once a week; second semester.* (Offered for 1921-22, and in alternate years.) Assistant Professor MCDOUGALL

28a-28b. Taxonomy of Economic Fungi.—Advanced practise on selected groups of parasitic fungi. *Once a week; both semesters.* Professor STEVENS

29a. Comparative Morphology of Pteridophytes, Bryophytes and Angiosperms.—Character and scope of work on problems of special interest, with repetition of some phases of this work. *Once a week; first semester.* Dr. HAGUE

BUSINESS ORGANIZATION AND OPERATION

Work may be done in the field of business organization and operation for a major or a minor for the M.S. degree, and for a minor for the doctorate. To do major work in this field, the student must have completed an undergraduate curriculum equivalent to that of the college of commerce and business administration. To do minor work, he must have had at least five semester hours' credit in the principles of economics and at least six semester hours in accounting and business law, respectively.

Courses for Graduates

101. Regulation and Control of Mercantile Distribution.—Federal, state, and local regulation of mercantile business; unfair competition; trade agreements; trade marks; inspection of mercantile establishments; pure food acts; control over weights and measures, packing, storage, and shipment. *Twice a week; both semesters. One unit.* (Not given, 1920-21.)

102. Scientific Management.—The history of the scientific management movement; critical study of the proposed systems. *Twice a week; both semesters. One unit.* (Not given, 1920-21.)

Course for Graduates and Advanced Undergraduates

4. Industrial Organization and Management.—Problems of organization and of administrative policy; supervision and management of industries and industrial units, etc. *Twice a week; second semester.* (Not given, 1920-21.)

CERAMIC ENGINEERING

Graduate work leading to degrees in either ceramic chemistry or ceramic engineering is offered by the department. Graduate students who wish to elect ceramic chemistry as their major field of study must have had the equivalent of twenty-five semester hours in chemistry and this must include satisfactory courses in general chemistry, qualitative and quantitative analysis, and either physical or organic chemistry. Such students must also have had at least one year of college physics and a training in mathematics which includes the calculus.

Candidates for the degree of Doctor of Philosophy in ceramic chemistry must fulfill the same general requirements in chemistry as candidates in other branches of chemistry. They must also offer physical chemistry as one of their minor subjects.

Courses for Graduates

101. The Chemistry of the Compounds of Silicon.—*Twice a week; both semesters. Three-fourths unit.* (Not given, 1920-21.)

Professor WASHBURN

103. Silicon Chemistry.—Laboratory to supplement course 101, which must precede or accompany it. *One to two units. Second semester.*

Professor WASHBURN

102. General Technology of the Clay Industries.—Physical properties of ceramic materials and products; dependence on chemical composition, mineralogical constitution, and physical condition. *One to two units. Both semesters.* Professor PARMELEE

104. Technology of Glass.—Glassy silicates; limiting composition; physical and chemical properties of glasses and the dependence of these properties on composition. Lectures and laboratory. *One to two units.*

Professor PARMELEE

Courses for Graduates and Advanced Undergraduates

4. Drying and Burning.—Chemical and physical processes; types of equipment. *Four times a week; first semester.* Assistant Professor HURSH

5. Ceramic Bodies.—Composition and properties of ceramic body mixtures; effects of various ingredients; development of special bodies. *Daily; second semester.* Professor PARMELEE

6. Glazes.—Classes of glazes and enamels; composition, limits, properties and defects. *Three times a week; first semester.* Professor PARMELEE

8. Glass.—Raw materials, preparation, compounding, melting and shaping; chemical principles in the manufacture and decoration of vitreous silicates. *Twice a week; second semester.* Professor PARMELEE

9. Ceramic Construction. — Plans, specifications, and estimates for ceramic equipments and industrial plants. *Four times a week; second semester.*

Assistant Professor HURSH

10. Cements.—Cements, limes, plasters; composition; reactions; manufacture and testing. *Three times a week; first semester.*

Assistant Professor HURSH

13. **Cement Laboratory.**—Silicate cements. *Three times a week; second semester.* Assistant Professor HURSH

14. **Cement Laboratory.**—Lime and gypsum products; magnesia and other special cementing materials. *Three times a week; second semester.* Assistant Professor HURSH

15. **Glass Laboratory.**—Soda-lime, potash-lime, lead, barium, and zinc silicates; boro-silicates; fused and solidified glasses; problems. *Three times a week; second semester.* Professor WASHBURN

16. **Glasses and Enamels.**—(Continuation of Ceramic Engineering 15.) Opaque, colored, and optical glasses; the enameling of metals. *Three times a week; second semester.* Professor PARMELEE

17. **The Principles of Physical Chemistry with Special Reference to Their Applications to Ceramic Materials and Process.**—*Three times a week; first semester.* Professor WASHBURN

20. **Refractory Materials.**—Properties and uses of refractory materials employed in the industries; relation between refractory power, chemical composition and physical condition; changes undergone by refractory materials at high temperatures. The subject will be presented as far as possible from the standpoint of the Phase Rule. Lectures and discussions. Assigned reading. *Twice a week; second semester.* Professor WASHBURN

CHEMISTRY

Graduate students who elect chemistry as their major subject of study must have had the equivalent of 25 semester hours in chemistry, including satisfactory courses in general chemistry, qualitative and quantitative analysis, and either physical chemistry or organic chemistry. They must also have had one year of college physics, mathematics through analytical geometry and, if they do not present an acceptable course in physical chemistry, the calculus. The ability to use the calculus is a prerequisite to all courses in physical chemistry.

Before receiving a degree in chemistry the student must have completed work equivalent to courses 31, 33 (or 102 and 102a), 14a, 14b, 9a, 9b. He is advised to take at least brief courses in the history of chemistry, gas analysis, metallurgy, water analysis, assaying, and chemical technology.

For students taking chemistry as a major, courses 14a, b, c, and d, 31, and 33 will be accepted only if on entering the Graduate School they have had the equivalent of 25 semester hours in chemistry.

Graduate students whose major subject is in some other department than chemistry, must have had the equivalent of 15 semester hours in chemistry. The ground covered must include satisfactory work in general chemistry and in qualitative and quantitative analysis. Such students are advised to make selections from the following courses: Chemistry 31, 33, (or 102, 102a), 14a, 14b, 9a, 9b, 15, and 25. Students will not be admitted to courses of a special nature, for graduate credit, unless they have previously taken the appropriate prerequisite courses from the above list.

Courses for Graduates

101. Theories of Chemistry.— Seminar. *Once a week; second semester. One-fourth unit.* Professor Noyes

102. Advanced Physical Chemistry.—The more important developments in physical chemistry. The kinetic theory, kinetic molecular methods, probability, Brownian movement. Atomic and molecular structure, the electron, radioactive disintegration, the quantum theory and its applications. Radiation. Thermodynamics, the first two laws. Theories of solution, thermodynamic potentials and fugacity. Free energy. The Nernst heat theorem. Lectures; problems. McLewis: A System of Physical Chemistry. *Twice a week; both semesters. Three-fourths unit.* Associate Professor ————

103. Advanced Inorganic Chemistry.—Descriptive inorganic chemistry; the rarer elements; periodic system. *Two to five times a week; both semesters. One-half to one and one-fourth units.* Associate Professor Hopkins

103a Advanced Analytical Chemistry.—*One to five times a week; second semester. One-half to one and one-fourth units.*
Assistant Professor Braley

103b. Special Topics in Analytical Chemistry.—Reports on the current literature of analytical chemistry, inorganic and organic. Required of all students taking a major or minor in analytical chemistry. Seminar. *Once a week; both semesters. One-half unit.* Associate Professor Beal

103c. Special Topics in Inorganic Chemistry.—Seminar. Rare earths. *Once a week; both semesters. One-fourth unit.* Associate Professor Hopkins

104. Advanced Organic Chemistry. — Geometric isomerism; optical isomerism; tautomerism; mechanisms of important reactions. *Twice a week; first semester. Three-fourths unit.* Professor Adams

104a. Advanced Organic Chemistry.—Special topics selected from the following: Carbohydrates; proteins; ureides; alkaloids; terpenes; relationships between chemical constitution and physiological properties; color and constitution; trivalent carbon; bivalent carbon; application of physical methods to organic problems, etc. *Twice a week; second semester. Three-fourths unit.*
Associate Professor ————

104b. Advanced Quantitative Organic Analysis.—The proteins, alkaloids, glucosides, volatile oils, and other constituents of animal and vegetable tissues. *Twice a week; both semesters. Three-fourths unit.*
Associate Professor Beal

104c. Organic Chemistry.—Current literature. Required of all students majoring in organic chemistry. *Once a week; both semesters. One-fourth unit.*
Professor Adams, Associate Professor ————

104d. Advanced Organic Chemistry.—Systematic study of the general reactions in organic chemistry. *Twice a week; second semester. Three-fourths unit.* Professor Adams

104e. Advanced Organic Chemistry.—Chiefly laboratory work. The study and development of methods which are suitable for large scale production. (Not given, 1920-21.) *Both semesters. One unit.*
Professor Adams, Associate Professor ————

105. Advanced Physiological Chemistry. — Structure and distribution of proteins; intermediary metabolism and the glands of internal secretion. *Twice a week; second semester. Three-fourths unit.*

Associate Professor LEWIS

105a. Advanced Physiological Chemistry.—Difficult biochemical preparations; the use of the newer analytical methods. *One to five times a week; second semester. One-half to one unit.* Associate Professor LEWIS

105b-105c. Advanced Physiological Chemistry.—Recent development. *Twice a week; both semesters. One-half unit.* Associate Professor LEWIS

106. Animal Chemistry (Animal Nutrition).—*Five times a week; both semesters. One to one and one-half units.* Professor GRINDLEY

107. Special Coal Problems.—Oxygen absorption; storage factors; deterioration and spontaneous combustion; unit coal values; contracts; specifications; inspection. *Once a week; first semester. One-fourth unit.* (Given first semester, 1919, and alternately with 107a.) Professor PARR

107a. Fuel Technology.—Fuel types: solid, liquid, and gaseous; sources, output, prospective supply, and industrial interrelations; conservation and combustion problems. *Once a week; first semester. One-fourth unit.* (Given first semester, 1920, and alternately with 107.) Professor PARR

107b. Special Topics in Gas Engineering.—Theories and processes of carbonization; by-product constituents and recovery. *Once a week; second semester. One-fourth unit.* Professor PARR

108. Advanced Metallography.—Selected alloy systems; correlation of constitution and properties. *Twice a week; both semesters. Three-fourths unit.*

Associate Professor ————

109. Advanced Industrial Chemistry. — Chemical industries; development and chemical control of processes. *Twice a week; both semesters. Three-fourths unit.* Associate Professor ————

110. Water Supplies.—Sources of contamination of water supplies; purification for potable or technical use. *One to five times a week; both semesters. One-half to one unit.* Professor ————

111. Research.— *Both semesters.*

Physical and Electrochemistry.

Professor ————

Inorganic Chemistry.

Associate Professor HOPKINS, Assistant Professor REEDY

Analytical Chemistry.

Associate Professor BEAL, Assistant Professor BRALEY

Food Chemistry.

Associate Professor BEAL

Organic Chemistry.

Professors NOYES, ADAMS, Associate Professor ————

Water Chemistry.

Professor ————

Physiological Chemistry.

Associate Professor LEWIS

Animal Chemistry (Nutrition).

Professor GRINDLEY

Industrial Chemistry.

Professor PARR, Associate Professor ———
Assistant Professor LAYNG

Ceramic Chemistry.

Professor WASHBURN

Courses for Graduates and Advanced Undergraduates

*6. **Chemical Technology.**—Technological chemistry as illustrated in those industries having a chemical basis for their principal operation and processes. *Three times a week; second semester.* Associate Professor ———

*7. **Metallurgy.**—General metallurgy; metallurgy of iron and steel. Fulton's *Principles of Metallurgy;* Stoughton's *Iron and Steel. Three times a week; first semester.* Associate Professor ———

7a. **Metallurgy of the Non-Ferrous Metals.**—Copper, lead, zinc, gold, and silver. *Three times a week; second semester.*
Associate Professor ———

10a.—**Study of Water Supplies.**—History, sources, contamination, and standards of purity of potable waters and waters for industrial purposes; analytical methods. *Three times a week; second semester.* Professor ———

14a-14b. **Organic Chemistry.**—Noyes' *Organic Chemistry.* (This course should be accompanied by Chemistry 14c and 14d.) *Four times a week; first semester; twice a week, second semester.* Professor NOYES

14c. **Organic Chemistry Laboratory.**—Organic synthesis. *Twice a week; first or second semester.* Associate Professor ———

14d. **Organic Chemistry Laboratory.**—Organic synthesis; quantitative and qualitative analysis. (Continuation of 14c, to accompany 14b.) *Twice a week; first or second semester.* Associate Professor ———

15. **Physiological Chemistry.**—*Five times a week; first semester.*
Associate Professor LEWIS

15a. **Problems of Metabolism.**—Intended especially for medical students. *Three times a week; second semester.* Associate Professor LEWIS

21. **Qualitative Organic Analysis.**—Identification of pure organic compounds and mixtures. *Twice a week; first semester.*
Associate Professor ———

25. **Food Analysis.**—Quantitative organic analysis, with special reference to the examination of food products: alcohols, carbohydrates, fats, and oils, cereals, nitrogenous bodies, preservatives, and colors. *Five times a week; first semester.* Associate Professor BEAL

26. **Pharmaceutical Chemistry.**—The analytical chemistry of medicinal substances, with a discussion of the common types of pharmaceutical preparations. *United States Pharmacopoeia, Ninth Decennial Revision. Three times a week; second semester.* Associate Professor BEAL

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*Certain required inspection trips will be arranged in connection with courses 6 and 7. Students registering in these courses should take into consideration the expense involved, which will approximate $15.00 for each course.

27. **Qualitative Analysis of the Rare Elements.**—*Three times a week; first semester.* Associate Professor HOPKINS

28. **Advanced Qualitative Analysis.**—Designed especially for those intending to teach qualitative chemistry. *One to three times a week; second semester.* Associate Professor HOPKINS

31. **Elementary Physical Chemistry.**—The more important principles of physical chemistry. The purpose of this course is to give the experimental basis for a proper appreciation of physical chemistry. Lectures, problems. Walker: *Introduction to Physical Chemistry. Twice a week; second semester.* Dr. DIETRICHSON

33. **Elementary Physical Chemistry.**—A laboratory course to accompany Chemistry 31. Findlay: *Practical Physical Chemistry. Twice a week; second semester.* Dr. DIETRICHSON

34. **Physical and Electrochemistry.**—The theoretical principles of physical and electro chemistry and their applications. Including the mass law, the phase rule, thermochemistry, surface tension, colloids, catalysis, electrolytic and electrothermal processes, photochemistry. Lectures; problems. Washburn: *Principles of Physical Chemistry.* Rideal and Taylor: *Catalysis in Theory and Practice. Twice a week; both semesters.* Professor ————

35. **Electrochemistry.**—Electrochemical reactions. Technical applications, including electric furnace processes. *Three times a week; first semester.* Dr. DIETRICHSON

46. **Chemistry of Plant Products.**—The occurrence of organic compounds in plants and their relation to plant nutrition. Lectures and laboratory. *Twice a week; second semester.* Dr. ENGLIS

47. **Physical Methods in Inorganic Problems.**—Selected topics involving the application of the methods of physical chemistry. Stewart: *Recent Advances in Physical and Inorganic Chemistry.* (Third Edition.) Recitations; assigned readings. *Twice a week; first semester.* Assistant Professor REEDY

61. **Industrial Chemistry Laboratory.**—The preparation and purification of chemical products from raw materials on a scale sufficient to afford data for determining the economy of the processes employed. (This course should be accompanied by either 6 or 109.) *Three times a week; second semester.* Associate Professor ————

65. **Fuels and Flue Gases.**—Fuel inspection; gas analysis; determination of calorific values; calculation of efficiencies. *Three times a week; first semester.* Professor PARR

66. **Gas Engineering.**—Gas machinery; ovens and appliances for carbonization; recovery of by-products. *Once a week; second semester.* Professor PARR

66a. **Control Processes in Gas Manufacture.**—Standardization methods; gas yield; inspection of by-product. *Once a week; second semester.* (Not given in 1921.) Professor PARR

69. **Metallurgical Laboratory and Assaying.**—The principles of metallurgy as illustrated in the fire assay of gold, silver, lead, and copper ores, mattes, and bullion. Pyrometric measurements, etc. *Twice a week; first semester.* Associate Professor ————

72. **Paints, Oils, Turpentines, Varnishes, and Protective Coverings for Wood and Metals.**—*Twice a week; first semester.*

Professor PARR and Assistant Professor LAYNG

76. **Chemistry of Oils.**—Fractionation; analysis; evaluation for fuel; gas manufacture; lubrication. *Twice a week; second semester.* (Given in 1918 and in alternate years.)

Professor PARR and Assistant Professor LAYNG

77. **Composition and Classification of Coal.**—Classification; changes in composition; formation of mine gases. *Once a week; second semester.*

Professor PARR

78. **Metallography.**—Constitution and microstructure of metals and alloys; properties, chemical and mechanical treatment, and structure. *Twice a week; second semester.* Associate Professor ————

95. **History of Chemistry.**— *Twice a week; first semester.*

Besides the formal courses outlined above, regular scientific meetings are held by the colloquiums of industrial, physical, inorganic, physiological, and organic chemistry; by the Chemical Club; by Phi Lambda Upsilon; and by the University of Illinois Section of the American Chemical Society.

CIVIL ENGINEERING

The prerequisite for graduate work in civil engineering is the equivalent of the undergraduate course required for the degree of Bachelor of Science in civil engineering in the branches of the subject in which registration is desired.

Courses for Graduates*

101. **Irrigation and Drainage.** — Survey, examination, construction, maintenance, and operation of works for irrigation and drainage of agricultural lands: the rights to the use of water. *Twice a week; both semesters. Half unit.* Professor NEWELL

103. **Highway Construction.**—Machinery and methods of handling materials. Contractor's organization and official control. *Twice a week; both semesters. One unit.* Professor BAKER

106. **Reinforced Concrete Design.**—Elastic theory. *Twice a week; both semesters. One to two units.* Professor ELLIS

107. **Bridge Engineering.** — Deflections; the statically indeterminate frame; swing bridges and arches; special graphical methods; suspension bridges; secondary stresses; impact. *Twice a week; both semesters. One to two units.*

Professor ELLIS

124.—**Steel Building Construction.**—Steel framing of fireproof office, industrial, and hotel buildings; wind bracing; long columns; eccentrically loaded columns; eccentric connection; analysis of special details. *Twice a week; both semesters. One to two units.* Professor ELLIS

*Courses offered to Junior and Senior students are open for minor credit to students majoring in other fields.

THE CLASSICS

The Degree of Master of Arts in the Classics.—The major may be either Latin or Greek.

Before the period of the regular course examinations of the second semester, each candidate must also pass two examinations which are to be regarded as tests of attainment rather than as a requirement of special or additional preparation. The first examination consists of written translation at sight, from the candidate's major language, or passages equivalent in difficulty to the work of first-year graduate courses. The second examination is oral and designed to determine the candidate's general ability and his advancement in the various fields of classical philology, especially those treated in course 110, Bibliography and Criticism.

The Degree of Doctor of Philosophy in the Classics.—The degree is given in classical philology. Major work may be taken in either Latin or Greek, but whichever language is taken as a major, the other must be taken as the first minor.

Greek

Preparation for first-year graduate work in Greek must include at least two years of preparatory Greek, two years of college Greek, and two years of college Latin. A reading knowledge of French or German, preferably the latter, is highly desirable for candidates in this subject. The study of history and philosophy is especially recommended.

Courses for Graduates

104. Homer and the Homeric Question.—Lectures and readings in alternate hours. *First semester. One unit.*

Professor Oldfather

106. Greek Drama.—Lectures; reading and discussion of selected plays from the great dramatists. *Twice a week; second semester. One unit.*

Professor Pease

110. Bibliography and Criticism.—Thesis course; the same as Latin 110. *Once a week; both semesters. One unit.*

Professors Oldfather, Pease, and others

Courses for Graduates and Advanced Undergraduates

7. Greek Drama.—Three plays from the great dramatists. *Three times a week; first semester.* Professor Pease

8. Plato.— Selected dialogues. *Three times a week; second semester.*

Professor Pease

Latin

Preparation for first-year graduate work in Latin must include at least two years of preparatory Latin, and four years of college Latin, or three years of preparatory Latin and three years of college Latin. A reading knowledge of French or German, preferably the latter, is highly desirable. Some acquaintance with Greek is indispensable, and the study of history and philosophy is especially recommended.

Courses for Graduates

101. **Latin Epigram.**—*Twice a week; first semester. One unit.*
Professor CANTER

103. **Cicero.**—Selections from his philosophical works. *Twice a week; second semester. One unit.* Professor PEASE

104. **Latin Paleography.**—*Twice a week; first semester. One unit.*
Professor PEASE

106. **Terence.**—*Twice a week; second semester. One unit.*
Professor OLDFATHER

108. **Tacitus.**—The Histories. *Twice a week; second semester. One unit.*
Professor BARTON

109. **Vergil.**—*Twice a week; first semester. One unit.*
Professor PEASE

110. **Bibliography and Criticism.**—(Thesis course; the same as Greek 110.) *Once a week; both semesters. One unit.*
Professors OLDFATHER, PEASE, and others

Courses for Graduates and Advanced Undergraduates

7. **Horace and Juvenal.**—Selections from the Satires and Epistles of Horace. Selected Satires of Juvenal. *Three times a week; second semester.*
Professor PEASE

14. **Seneca.**—Selections from his Letters. *Three times a week; first semester.* Professor BARTON

COMPARATIVE PHILOLOGY

Course for Graduates

101. **Comparative Philology of the Indo-European Languages.**—Greek, Latin, and the Germanic languages, including English. *Second semester; twice a week.* Assistant Professor BLOOMFIELD

Courses for Graduates and Advanced Undergraduates

1. **Introduction to the Study of Language.**—Phonetics; the development of forms of speech; dialects and the spread of languages; the study and teaching of languages. *First semester; three times a week.*
Assistant Professor BLOOMFIELD

3. **Elementary Sanskrit.**—*First semester; three times a week.*
Assistant Professor BLOOMFIELD

4. **Elementary Sanskrit.**—(Continuation of 3.) *Second semester; three times a week.* Assistant Professor BLOOMFIELD

DAIRY HUSBANDRY

Candidates for the master's degree may take their major work in dairy husbandry, preparing a thesis in the field of dairy bacteriology, dairy chemistry, or milk production. Such students must have had at least 10 semester hours of previous work in dairy husbandry, including adequate preparation for the desired graduate courses.

Candidates for the master's degree desiring a minor in dairy husbandry must have had the introductory work regularly required to enter the desired course or courses.

Candidates who desire to register for a doctorate with their major interest in dairy bacteriology as well as those who desire to take dairy bacteriology as a part of a minor for the doctorate should register in bacteriology according to the regulations given under bacteriology on page 29.

Courses for Graduates

101. Economic Milk Productions.—Efficiency of dairy farms; factors influencing profits. *Twice a week; both semesters. One or two units.*
Professor Fraser

104. Scientific Readings.—Discussion of bacteriological problems based on selected German or French texts. (Recommended for first and second year students.) *Once a week; both semesters. One-half unit.*
Professor Harding, Professor Prucha

105. Bacteriological Literature.—Each student is required to prepare and deliver an acceptable course of lectures. (Recommended for second-year and third-year men.) *Once a week or once in two weeks; both semesters. One-half or one unit.* Professor Harding

106. Research on Assigned Problems. — (Open to graduate students whose development permits their undertaking problems of dairy bacteriology with only general supervision.) *Both semesters. One-half to two units.*
Professor Harding, Professor Prucha

107. Dairy Chemistry.—Assigned problems. *Once a week; both semesters. One unit.* Assistant Professor Overman

108. Physiology of Milk Production.— *Once a week; first semester. One-half to two units.* Professor Gaines

Courses for Graduates and Advanced Undergraduates

4. Ice Cream Making.—Lectures; laboratory. *Three times a week; second semester.* Assistant Professor ————, Mr. Ambrose

5. Composition of Dairy Products.—Lectures; recitations; problems; assigned reading; laboratory. *Three times a week; second semester.*
Assistant Professor Overman

7. Creamery Buttermaking and Factory Management.—Lectures; laboratory. *Six times a week; second semester.*
Assistant Professor ————, Mr. Ambrose

10. Dairy Bacteriology.—Study of some of the more important relations of bacteria to milk and its products. Lectures; laboratory. *Three times a week; first semester.* Professor Prucha

11. Dairy Bacteriology.—Bacteria in milk and its products; sources, effect on milk, and method of control. *Twice a week; first semester.* (Not given, 1920-21.) Professor Harding

12a-12b. Dairy Bacteriology.—Laboratory work supplementing Dairy Husbandry 11. *Four times a week; both semesters.* (Not given, 1920-21.)
Professor Harding

17. Advanced Study of Dairy Breeds. — Lectures; assigned reading; seminar work. *Twice a week; first semester.* Mr. Yapp

20. Economic Problems in Dairy Farming.—*Three times a week; first semester.* Professor Fraser

21. Economic Milk Production.—*Five times a week; second semester.* Professor Fraser

ECONOMICS

Every student entering on major graduate work in economics must have had a course in the principles of the science and also in some special part of the field such as public finance or money and banking. The work must represent at least eight semester hours. He must also have had at least one semester's work in English, American, or general European history; and at least three hours in political science.

Those who take the subject as a minor must have had a course of at least five semester hours in the principles.

Graduate students who are making economics their major are required during their first year to acquaint themselves with the works of the masters in the science, either by taking course 101 or by private reading for examination. In the second or third year they are expected to elect course 105 and some fundamental course in political science and sociology unless they have already had such courses.

The following courses may be taken by students in general economics for major or minor credit: all numbered above 100; 4, 5, 10, 11, 12, 13, 14, 15, 17, 19, 20, 21, 29, 32, 61. The following may be taken for minor credit only: 8, 8c, 9, 28, 31.

Two units will be accepted for a first minor for the master's degree; and four two or three hour graduate courses, or their equivalent in advanced undergraduate courses, for a first minor for the doctor's degree.

Courses in transportation may be included in their programs by students of economics as part of either their major or minor subjects. See Transportation.

Courses for Graduates

101. Economic Theory.—*Twice a week; both semesters. One unit.* Professor Weston

104. Foreign Commerce.—*Twice a week; both semesters. One unit.* Professor Litman

105. Public Finance.—*Twice a week; both semesters. One unit.* Professor Bogart

107. The Corporation in Economic Evolution.—*Twice a week; both semesters. One unit.* Professor Robinson

109. Theory of Industrial Consolidation.—The nature, causes, and effects of industrial consolidation; prices, profits, and wages. *Twice a week; both semesters. One unit.* (Not given, 1920-21.) Professor Robinson

110. **Investments.**—Nature, character, and function of investments; classes including direct investment and securities of various types; methods of judging investments; state control. *Twice a week; both semesters. One unit.* (Not given, 1920-21.) Professor ROBINSON

118. **Seminar.**—Bi-weekly discussion of the results of students' investigations.

122. **Advanced Economic History of the United States.**—*Twice a week; both semesters. One unit.* (Not given, 1920-21.) (See Economics 19 and 20.) Professor BOGART

Theory of Statistics.—See Mathematics 129.

Courses for Graduates and Advanced Undergraduates

4. **Financial History of the United States.**—*Three times a week; second semester.* Assistant Professor HUNTER

5. **Public Finance.**—Public debts, revenue, taxation, etc. *Three times a week; first semester.* Assistant Professor HUNTER

8. **The Money Market.**—*Twice a week; second semester.* (Not given, 1920-21.) Professor WESTON

8c. **Foreign Exchange and International Banking.**—*Twice a week; second semester.* Professor WESTON

9. **Practical Banking.**—*Twice a week; first semester.* (Not given, 1920-21.) Professor WESTON

10. **Corporation Management and Finance.**—*Three times a week; second semester.* Professor ROBINSON

11. **Industrial Consolidation.** — Development; plans for controlling trusts. *Twice a week; first semester.* Professor ROBINSON

12. **Labor Problems.**—*Three times a week; both semesters.* Associate Professor WATKINS

13. **Economic Development of Europe Since the Industrial Revolution.** —*Three times a week; first semester.* Professor BOGART

14. **Agricultural Co-operation.**—*Twice a week; second semester.* Dr. WRIGHT

15. **Financing Agriculture.**—*Twice a week; second semester.* Dr. WRIGHT

17. **Economic History of Agriculture.**—*Twice a week; second semester.* (Not given, 1920-21.) Dr. WRIGHT

19. **Economic History of the United States, 1820-1860.**—*Twice a week; first semester.* Professor THOMPSON

20. **Economic History of the United States Since 1860.**——*Twice a week; second semester.* Professor THOMPSON

21. **Socialism and Economic Reform.**—*Twice a week; second semester.* Associate Professor WATKINS

28. **Mechanism and Technic of Domestic Commerce.**—*Three times a week; first semester.* Professor LITMAN

29. **International Trade and Trade Policies.**—*Twice a week; second semester.* Professor LITMAN

31. **Organization of Foreign Commerce.**—Exporting and importing; means of communication and of transportation; the shipping business; duties of consuls. *Three times a week; second semester.* Professor LITMAN

32. **Marketing and Prices of Agricultural Products.** — *Twice a week; first semester.* Dr. WRIGHT

61. **Economic Theory.**—*Twice a week; both semesters.* Professor THOMPSON

EDUCATION

Students who elect education as a major subject must have completed at least a three-hour course in the principles of education, a course of at least the same length in the history of education, and a minimum of three hours each in psychology and philosophy. For graduate students who have had experience in teaching, these requirements may be modified.

Courses for Graduates

101. **Seminar in Educational Theory.**—*Once a week, two hours; first semester. One unit.* Professor BODE

102. **Research in History of American Education.**—*Once a week, two hours; first semester. One unit.* Associate Professor SEYBOLT

103. **Research in History of American Education.**—*Once a week, two hours; second semester. One unit.* Associate Professor SEYBOLT

104. **Seminar in Educational Administration.**—*Once a week, two hours; second semester. One unit.* Dean CHADSEY

105. **Seminar in Modern European Education.**—*Once a week, two hours; first semester. One unit.* Associate Professor SEYBOLT

121. **Seminar in Educational Measurements.**—*Once a week, two hours; second semester. One unit.* Associate Professor MONROE

125. **Seminar in Educational Psychology.**—Psychology of school subjects. *Once a week, two hours; first semester. One unit.* Professor CAMERON

Courses for Graduates and Advanced Undergraduates

4. **Problems of Educational Administration.**—Interpretation of present tendencies. *Three times a week; first semester.* Dean CHADSEY

6. **Principles of Secondary Education.**—*Three times a week; first semester.* Assistant Professor BELTING

11. **History of Ancient and Medieval Education.**—*Three times a week; first semester.* Associate Professor SEYBOLT

12. **History of American Education.**—*Three times a week, second semester.* Associate Professor SEYBOLT

16. **Educational Finance.**—*Three times a week; second semester.* Professor BUCKINGHAM

17. **Education. The Teacher.** — Preparation, selection, placement agencies, requirements for certification, salary, pensions, methods of promotion in service, professional ethics. Lectures, reading, and discussions. *Twice a week; first semester.* Mr. WILLIAMS

18. Theory of Educational Measurements.—*Three times a week; first semester.* Associate Professor MONROE

20a. Supervision of Secondary Education.—*Three times a week; first semester.* Mr. CAPPS

23. Educational Statistics.—*Three times a week; first semester.* Professor BUCKINGHAM

27. High School Curriculums.—*Three times a week; second semester.* Assistant Professor BELTING

28. The Project Method of Teaching.—*Twice a week; first semester.* Mr. CAPPS

41. Vocational Education.—*Three times a week; first semester.* Professor ————

43. Mental Tests.—Laboratory drill; tests of sensory capacities; attention; memory; learning; suggestibility; inventiveness; system of tests for diagnosis of mental age, general intellectual status; mental retardation. *Twice a week; second semester.* Professor CAMERON

44. Educational Psychology.— (Laboratory Course.) *Twice a week; first semester.*

45. Problems in Educational Psychology.—*Time to be arranged; first semester.* Professor CAMERON

50. Teaching.—*Five times a week; first and second semesters.* Mr. REID

51. Teachers' Course in Agriculture.—*Three times a week; first or second semester.* Associate Professor NOLAN

ELECTRICAL ENGINEERING

The prerequisite for graduate work in electrical engineering is the equivalent of the undergraduate courses required for the degree of Bachelor of Science in electrical engineering in the branches of the subject in which registration is desired.

Graduate students who wish to take a minor in electrical engineering must have had differential and integral calculus, and one year's work in college physics.

Courses for Graduates*

101. Advanced Course in Alternating Currents.—The theory of transient phenomena; polyphase circuits; measuring apparatus. *Twice a week; both semesters. One and one-half units.* Professor PAINE

103. Electrical Designs.—Plans for an electrical machine or apparatus of specified character; or for the arrangement of an electrical plant; or for the installation of such machinery or apparatus. *Twice a week; second semester. One unit.* Assistant Professor WALDO

105. Electrical Engineering Research.—Investigation of electrical phenomena, or test of some electrical machine or apparatus. *Twice a week; both semesters. One to three units.* Professor PAINE, Professor BROOKS

*Courses offered to Junior and Senior students are open for minor credit to students majoring in other fields.

ENGLISH LANGUAGE AND LITERATURE

Students who enter on graduate work with English as their major subject are required to give evidence of their ability to write good English. They must present the equivalent of fourteen hours of undergraduate work in English literature, the required college work in rhetoric, and the equivalent of four semesters of college work in a language other than English. After the first year of graduate work a knowledge of French and German is indispensable.

Students making English their minor may be admitted to such courses as in the judgment of the instructor in charge they are qualified to pursue.

The Degree of Master of Arts in English.—In addition to complying with the general rules of the Graduate School, candidates for the degree of Master of Arts in English must comply with the following rules of the Department of English: (1) they must choose a portion of their work from the group of courses described as "for graduates;" (2) must offer an elementary course in Anglo-Saxon; and (3) must take, besides the regular semester examinations in all their courses, a general examination, oral or written as the department may prescribe, which shall be a final test of the candidate's fitness and ability.

The Degree of Doctor of Philosophy in English.—Candidates for the degree of Doctor of Philosophy in English may expect to be examined on the entire field of the English language and literature. They are urged, furthermore, to acquaint themselves as fully as possible with the history and philosophy of the period in which their main interest lies, and with the foreign languages and literatures most closely related to English in that period.

Courses for Graduates

101. Research in Special Topics.—Guidance in writing theses for advanced degrees. *From one to two units.* Professor SHERMAN, Professor DODGE, Professor BERNBAUM, Associate Professor PAUL, Assistant Professor BALDWIN, Assistant Professor SCOTT, Assistant Professor JONES, Assistant Professor ZEITLIN, Assistant Professor HILLEBRAND.

110. Old English (Anglo-Saxon) Poetry.—*Twice a week; first semester. One unit.* Professor DODGE

112. The History of the English Language.—*Twice a week; both semesters. One unit.* (Not given, 1920-21.) Assistant Professor ZEITLIN

113. History of English Prose.—The forces, native and foreign, in the development of its vocabulary, syntax, and style. *Twice a week; both semesters. One unit.* Assistant Professor ZEITLIN

114. The Development of the Essay.—The English essay; continental influences; classical origins. *Twice a week; both semesters. One unit.* (Not given, 1920-21.) Assistant Professor ZEITLIN

120. The History of English Criticism.—Critical standards from Aristotle to Sainte-Beuve. The main types of criticism. *Twice a week; both semesters. One unit.* (Not given, 1920-21.)

126. Ballads.—Studies in the relation of folk poetry to literature. *Twice a week; first semester. One unit.* (Not given, 1920-21.)

127. **Metrical Romances.**—The beginnings of verse fiction. *Twice a week; second semester. One unit.* (Not given, 1920-21.)

128. **Spenser and the Beginnings of the English Renaissance.**—The persistence of certain medieval traditions reinforced by the Revival of Classical Learning; Catholicism and Calvinism as sources of literary inspiration. *Twice a week; both semesters. One unit.* (Not given, 1920-21.)
Assistant Professor JONES

129. **English Literature from Norman Conquest to Chaucer.**—Middle English authors exclusive of Chaucer. *Twice a week; both semesters. One unit.* Assistant Professor JONES

135. **Problems in American Literature.**—Poe, Lowell. *Twice a week; both semesters. One unit.* (Not given, 1920-21.) Associate Professor PAUL

136. **The Transition from the Seventeenth to the Eighteenth Century, 1675-1725; the Rise of Classicism.**— *Twice a week; both semesters. One unit.* Associate Professor PAUL

137. **Prose Writers of the Nineteenth Century.**—Relation of literature to social forces; Mill, Carlyle, Newman, Ruskin, Arnold, and Pater. *Twice a week; both semesters. One unit.* (Not given, 1920-21.) Professor SHERMAN

138. **The Romantic Movement in England.**—*Twice a week; both semesters. One unit.* Professor SHERMAN

139. **The Sonnet Revival in the Eighteenth Century.**—Special topics for investigation and report, with emphasis on methods of research. *Twice a week; first semester.* (Not given, 1920-21.) Dr. RINAKER

140. **Investigations in Modern English Literature.**—(For second-year and third-year graduate students who are preparing theses for the doctor's degree.) *Three hours once a week; both semesters. One to three units.* (May be taken in successive years.) Professor BERNBAUM

141. **The History of Seventeenth Century English Literature to About the Year 1675.**—Poetry, beginning with Shakespere's Sonnets. *Twice a week; both semesters. One unit.* (The first semester may not be taken separately.)
Professor BERNBAUM

142. **The Conflict of Ideas and Ideals in Eighteenth Century Literature.** —*Twice a week; both semesters. One unit.* (Not given, 1920-21.)
Professor BERNBAUM

143. **The Origins of the English Novel, and Its History to the End of the Eighteenth Century.**—*Twice a week; both semesters. One unit.* (The first semester may not be taken separately.) Professor BERNBAUM

144. **Lincoln's Letters and Speeches.**—Development of style, relation to period, textual study, contemporary estimates. *Twice a week; second semester. One unit.* Professor DODGE

Courses for Graduates and Advanced Undergraduates

A. English Literature and Language

3. **The Poetry of Milton.**—Origins, forms, artistic and ethical values; Milton's place in English literary history. *Three times a week; second semester.*
Assistant Professor BALDWIN

4. **English Versification.** — Verse forms; reading of representative poems. Verse composition; individual conferences. *Three times a week; first semester.* (Not given, 1920-21.)

5. **Shakespeare.**—Six plays, with special emphasis on *Hamlet. Three times a week; second semester.* Professor Dodge

8-9. **Old English (Anglo-Saxon).** — Grammar; prose; short poems; *Beowulf.* (The first semester may be taken separately.) *Three times a week; both semesters.* Professor Dodge

17. **The English Language.**—History, characteristics, and usage of modern English. *Three times a week; second semester.* Assistant Professor Zeitlin

18. **Modern English Grammar.**—Sentence structure and analysis; grammatical categories; peculiarities of English syntax. *Three times a week; second semester.* (Not given, 1920-21.) Assistant Professor Zeitlin

25. **Chaucer.**—*Three times a week; first semester.* Assistant Professor Jones

27-28. **Studies in the Relations of Journalism and Literature.** —*First semester*: English Literary Periodicals and the genesis and evolution of the Periodical essay in the 17th and 18th Centuries. *Second semester*: The Magazine in America. *Twice a week; both semesters.* (Not given, 1920-21.) Assistant Professor Scott

35. **The English Drama from the Beginning to 1600** — [*Exclusive of Shakespeare*].—The Religious Drama, Morality Plays, Sackville, Udall, Lyly, Peele, Greene, Kyd, Marlowe, etc. *Three times a week; first semester.* Professor Dodge

36. **The English Drama from 1600 to 1700** [*Exclusive of Shakespeare*]. —Jonson, Chapman, Dekker, Marston, Heywood, Middleton, Beaumont and Fletcher, Webster, Ford, Massmyer, Dryden, Wycherley, Vanbrugh, Congreve, etc. *Three times a week; second semester.* Assistant Professor Hillebrand

38. **The Arthurian Tradition.**—The historical Arthur; Celtic influences; Old French Romances (in translation); the tradition in England to the present time, with especial attention to Malory and Tennyson. *Twice a week; second semester.* (Not given, 1920-21.)

39. **Introduction to the Literature of the Middle Ages.**—Classical influences. Principal types; epic, romance, legend, lay, allegory, fabliau, lyric. Important poems, both English and continental, will be read in translation. *Three times a week; second semester.* (Not given, 1920-21.)

45. **The Development of the Modern Drama.**—Dramatic tendencies in the Nineteenth century, both in England and on the Continent. *Three times a week; first semester.* Assistant Professor Hillebrand

49. **Literary Treatment of Economic and Social Problems, 1770-1870.** —*Three times a week; second semester.* Dr. Boyer

52. **The Great Novelists of the Nineteenth Century.**—Scott, Jane Austen, Dickens, Thackery, Hawthorne, George Eliot, Meredith, Hardy, Stevenson. *Three times a week; second semester.* Professor Bernbaum

53. **Matthew Arnold.**—His prose and poetry with special reference to the main currents of nineteenth century thought. *Three times a week; second semester.* Professor SHERMAN

54. **Introductory and Comparative Survey of the Greatest Greek, Latin, Italian, Spanish, French, German, and English Authors.**—*Three times a week; both semesters.* Professors OLDFATHER, OLIVER, FITZ-GERALD, LESSING, and BERNBAUM, and Dr. VAN HORNE.

The second semester may not be taken separately.

The assigned reading may be done in translation.

60a-60b. Thesis.—Special training in investigation for candidates for honors and for other seniors. *Once a week; both semesters.*
Assistant Professor ZEITLIN, and others

B. Rhetoric

17. **Advanced Composition.**—Practise writing, with special emphasis on structure; criticism of current periodical literature; development of material for reports, magazine articles, etc. (Open to a limited number of students, and only on recommendation.) *Three times a week; second semester.* Dr. BOYER

C. The Scandinavian Languages

Preparation for major graduate work in the Scandinavian languages or literature must include a good knowledge of one of the Scandinavian languages and systematic work in the undergraduate courses in Scandinavian. Any graduate student in language may, however, be admitted to the purely philological courses.

Courses for Graduates

101. **Old Norse.**—Introduction to the language. Reading of the *Prose Edda. Twice a week; both semesters. One unit.* Professor FLOM

103. **Old Swedish.**—Noreen's grammar and reader is used. *Twice a week; second semester. One unit.* (Not given, 1920-21.) Professor FLOM

110. **Advanced Old Norse.**—Lays of the *Elder Edda* and selections from the *Speculum Regale* (*Konungs Skuggsja*). *Twice a week; both semesters. One unit.* Professor FLOM

140. **Early Scandinavian Paleography.**—(The work is based on the facsimiles and photographs of manuscripts in the Scandinavian Collection of the University library.) Old English script will also be briefly considered. *Twice a week; second semester. One unit.* (Not given, 1920-21.)
Professor FLOM

150. **Research.**—Special problems in Scandinavian philology or literature. *Once a week; first semester. One-half to two units.* Professor FLOM

Courses for Graduates and Advanced Undergraduates

14. **History of Old Norse Literature.**—The mythical lays, the court poetry, the sagas, the ballads. *Twice a week; first semester.*
Professor FLOM

16. Introduction to the History of Early Scandinavian Culture.—The civilization of Scandinavia in the Ages of Stone, Bronze and Iron down to the close of the Viking migrations and the introduction of the Latin script. *Twice a week; second semester.* (Not given, 1920-21.) Professor FLOM

ENTOMOLOGY

The prerequisite for graduate work in entomology is two years of undergraduate biology, of which one year should be zoology. Entrance on major work in entomology requires Entomology 15 or its equivalent. A reading knowledge of French and German is necessary at least by the beginning of the second year.

Courses for Graduates

102. Research in the Morphology and Embryology of Insects.—*Twice a week; both semesters. One or two units.* Assistant Professor FOLSOM

108. Research in Economic Entomology.—*Once or twice a week; both semesters. One or two units.* Assistant Professor FOLSOM

109. Research in Systematic Entomology.—*Twice a week; both semesters. One or two units.* Professor MACGILLIVRAY

Courses for Graduates and Advanced Undergraduates

10. Taxonomy of Immature Insects.—External form of immature insects; identification of species. *Three times a week; both semesters.* Professor MACGILLIVRAY

11. Classification of the Coccidae.—Preparing scale insects for study; identification of genera and species; morphology, metamorphosis, and phylogeny. *Three times a week; both semesters.* (Not given, 1920-21.) Professor MACGILLIVRAY

15. Introductory Course.—Metamorphosis and development of insects; orders, suborders, and families; habits of species; anatomy of immature and adult insects; special adaptive structures; classification of insects. *Three times a week; first semester.* (Not given, 1920-21.) Professor MACGILLIVRAY

17. Insect Organogeny.—Adult and immature insects. *Three times a week; both semesters.* (Not given, 1920-21.) Professor MACGILLIVRAY

18. Insect Taxonomy.—Structures used in the classification of insects; identification of a representative collection of insects. *Five times a week; both semesters.* Professor MACGILLIVRAY

FRENCH

(See Romance Languages)

GENETICS

Instruction in courses leading to advanced degrees in genetics is offered by the departments of agronomy, animal husbandry, botany, horticulture, and zoology. The work is offered under the supervision of a committee representing these departments.

The prerequisites for major work in genetics are Botany 1 and 3a, Mathematics 2 and 4, and Zoology 1 and 2, or their equivalents. A reading knowledge of German and French is indispensable.

The prerequisite for minor work in genetics is 10 hours of botany or zoology.

Courses for Graduates

Agronomy

112. Plant Breeding.—Experiments at this station; methods and results reported from other states and from foreign countries. *Twice a week; both semesters. One to two units.* Professor Smith

Animal Husbandry

117. Genetic Experiments on Animals and Plants.—A survey of the biological and mathematical methods employed. *Two to five times a week; both semesters. One to two units.* Professor Detlefsen

112e. Research.—Experimental investigations in heredity and variation. (This course may be taken during the summer by special permission.) *Once a week; both semesters. One to two units.* Professor Detlefsen

Botany

101. Individual Plant Development.—Origin of the individual; external and internal factors in its development and physiologic performance; response of the cell, somatic and generative, to external factors. *Once a week; both semesters. One to two units.* Professor Hottes

Zoology

115. Factors of Individual and Racial Development. — Experimental embryology; regeneration; heredity; variation; evolution. *Twice a week; both semesters. One unit.* Professor Zeleny

124. Experimental Zoology.—Individual research course. *Both semesters. One to two units.* Professor Zeleny

Courses for Graduates and Advanced Undergraduates

Agronomy

22. Plant Breeding.—The improvement by breeding of field crops, including grains, grasses, and legumes. With practical application. *Twice a week; second semester.* Professor Smith

Animal Husbandry

30. Genetics. — Heredity, variation, elements of biometry, and their practical application to breeding. *Five times a week; first semester.* Professor Detlefsen

Botany

14a-14b. Heredity, Variation, Evolution.—Cells and members of plants; adaptations and changes; mechanism of heredity; evolution. *Twice a week; both semesters.* Professor Hottes

Horticulture

12. **Evolution of Horticulture Plants.**—History, botanical classification, and geographical distribution of cultivated plants; modification under culture; variation. *Three times a week; first semester.* Professor CRANDALL

Zoology

25-26. **Experimental Zoology.** — Experimental embryology; regeneration; heredity; variation; evolution. *Two to five times a week; both semesters.* (See also Mathematics 29; Zoology 8, 20.) Professor ZELENY

GEOLOGY

For graduate work in geology the student must have had at least a major in geology and an acceptable field training. Graduate students with adequate technical preparation may be admitted to certain graduate courses.

Under the present organization of the Department, the major field of study for the doctorate will be general geology. First and second minor subjects are available as follows: (a) historical geology, including stratigraphy and paleontology; (b) economic geology; (c) mineralogy and petrology; (d) physiography, including glaciology; (e) structural and metamorphic geology; (f) crystallography.

A first minor presupposes 4 units, and a second minor 2 units credit.

Courses for Graduates

101. **Advanced Crystallography.**—The methods used in measuring, projecting, and calculating crystal forms, and determining the physical properties of crystallized bodies. *Twice a week; both semesters. One unit.* Professor BAYLEY

135. **Research.**—Individual work under the supervision of members of the staff in their respective fields. *Once a week; both semesters and summer. One to four units.* Professor BAYLEY, Associate Professor QUIRKE, Assistant Professor LEIGHTON.

Courses for Graduates and Advanced Undergraduates

95. **Economic Geology.**—The occurrence, origin, and uses of coal, oil, building stones and bedded deposits of economic importance. Lectures; quizzes, and laboratory. *Three times a week; first semester.* Professor BAYLEY

96. **Economic Geology.**—The nature, occurrence, and origin of metaliferous deposits. Theories of ore deposition. *Three times a week; second semester.* Professor BAYLEY

42. **Stratigraphic Paleontology.**—The invertebrate index fossils of the successive geologic formations, from the Cambrian to the Tertiary. Field trip of 1-2 weeks required in the second semester. *Twice a week; both semesters.* Professor ————

6. **Optical Mineralogy.**—Introduction to the microscopic study of minerals, by means of their behavior in polarized light. Two lectures; four hours laboratory. *Three times a week; first semester.* Professor BAYLEY

7. Petrography.—The principles learned in Geology 6 applied to the study of rocks. The different types of rocks; their origin and classification. Study of representative suite of specimens in the hand specimen and thin section. *Three times a week; second semester.* Professor BAYLEY

GERMANIC LANGUAGES AND LITERATURE

Students desiring to take German as a major are required to have finished successfully a four years' course of undergraduate work in German, comprising a minimum of twenty-eight semester hours of credit. They are also required to be familiar with the principal works of the writers of the classical and modern periods of German literature, to show a general knowledge of the history of German literature, and to be able to follow lectures in the German language.

Of collateral subjects, a reading knowledge of Latin and French is required. It is desirable that candidates for the degree of Ph.D. have some knowledge of Greek. All students are to have had a course in German history.

Courses for Graduates

101. Seminar in Germanic Philology.—Training in original research. Results, when of value, may be published in the *Journal of English and Germanic Philology. Once a week; both semesters. One unit.* Professor GOEBEL

103. Introduction to the Historical Study of the Germanic Languages.—History of German philology; comparative grammar of the old Germanic dialects. *Twice a week; second semester. One unit.* Professor GOEBEL

104. Gothic.—Grammar and literature. *Twice a week; first semester. One unit.* Professor GOEBEL

105. Old High German.—Grammar and interpretation of the oldest literary documents. *Three times a week; second semester. One unit.* Dr. WILLIAMS

109. Goethe's and Schiller's Philosophy.— *Twice a week; both semesters. One unit.* Professor GOEBEL

110. Early German Drama.—German drama up to the Reformation: medieval religious drama, Shrovetide plays, beginnings of the humanistic drama. *Twice a week; first semester. One unit.* (Not given, 1920-21.) Assistant Professor BROOKS

113. German Literature of the Fifteenth and Sixteenth Centuries.—Luther and the Reformation, Mastersingers and Folksong, the Reformation drama. Hans Sachs, Brant, Fischart, the chap books, the English comedians. *Twice a week; second semester. One unit.* (Not given, 1920-21.) Assistant Professor BROOKS

115. History of German Literature During the Nineteenth Century.—*Twice a week; both semesters. One unit.* Professor LESSING

116. Medieval German Literature with Reference to Political, Religious, and Social History.—Research course. *Twice a week; both semesters. One unit.* (Not given, 1920-21.) Professor LESSING

117. History of German Literature During the Eighteenth Century.—*Twice a week; both semesters. One unit.* (Not given, 1920-21.)
Professor Goebel

118. The German Drama Since Schiller.—Research course. *Twice a week; both semesters. One unit.* (Not given, 1920-21.) Professor Lessing

119. The German Novel.—Research course. *Twice a week; both semesters. One unit.* (Not given, 1920-21.) Professor Lessing

121. Walther von der Vogelweide.— *Twice a week; second semester. One unit.* (Not given, 1920-21.) Professor Goebel

121b. Nibelungenlied.—*Twice a week; second semester. One unit.*
Professor Goebel

125. History of the German Language.—Evolution of the forms, syntax, and lexicography of the High German literary language. *Three times a week; second semester. One unit.* (Not given, 1920-21.)

Courses for Graduates and Advanced Undergraduates

8. Schiller.—The life of Schiller; *Wallenstein* and other selections. *Three times a week; second semester.* Professor Lessing

19a-19b. Goethe's Faust.—The Faust legend and early Faust books and plays; the genesis of Goethe's *Faust;* reading of both parts. *Twice a week: both semesters.* Professor Goebel

26a. German Literature to the End of the Reformation.—*Three times a week; first semester.* Professor Lessing

26b. German Literature after the Reformation.—*Three times a week; second semester.* Professor Lessing

27. Lessing.—The life of Lessing; *Nathan der Weise, Emilia Gallotti* and other selections. *Three times a week; first semester.* (Not given, 1920-21.)
Professor Lessing

31. Middle High German.—*Twice a week; first semester.*
Professor Goebel

39a-39b. Goethe's Poems; Goethe's Tasso; Schiller's Critical Essays.—*Twice a week; both semesters.* Professor Goebel

GREEK

(See Classics)

HISTORY

Graduate work in history requires two years of college work in this subject, or sixteen semester hours, which should ordinarily include introductory courses in European and American history. Linguistic preparation is important especially in French and German. For medieval history some knowledge of Latin is essential, and Spanish is useful for certain fields of American history.

Advanced courses in history at the University of Illinois are of three kinds: (1) Courses for information and guidance in general reading. (2) Instruction in methodology, historiography, and bibliography. A part of this work

(in course 103) is required of all graduate students in history during their first year. (3) Seminary courses for the study of special fields with a view primarily to training in the methods of historical criticism and research.

Illinois Historic Survey.—Historical students have an opportunity to pursue research in western history in connection with the Illinois Historical Survey, which is an organization for the purpose of carrying on systematic studies in the history of Illinois.

Attention is also called to the fact that the University of Illinois has for some time cooperated with the Trustees of the State Historical Library in the gathering and editing of archive material. As a result of this relation instructors and graduate students in the department have contributed from time to time to the publications of the Library and have been given useful training in the study of manuscript as well as printed material.

Higher Degrees in History. The following statement regarding the specific requirements for higher degrees in history is subject to the general requirements of the Graduate School.

Master of Arts

In addition to meeting the usual tests in the specific courses taken, each candidate is required to pass a general oral examination, and written examinations in two of the following fields: ancient history; medieval history of continental Europe; modern history of continental Europe; English history; American history. Candidates for this degree are expected to have a general knowledge of historical bibliography and methodology (see course 103).

Doctor of Philosophy

Major Requirements.—A candidate who selects history as his major subject may offer himself for examination in any four of the fields indicated below, stating also the particular field among these four in which he wishes to specialize and in which his thesis is to be written:

1. Ancient history. 2. Medieval history and institutions of continental Europe, to the close of the thirteenth century. 3. Continental Europe from 1300 to 1648. 4. Continental Europe and its dependencies since 1648 (except as included in 5 and 6). 5. The history of England and its dependencies, (not including America before 1783). 6. American history (except as included in 5, and with primary reference to the United States). This enumeration of fields is not to be regarded as excluding the possibility of accepting others as may be determined by the department in individual cases.

Minor Subjects.—A candidate for the doctorate in history may select as his first minor one of the divisions of the field of history listed above which is not offered as a part of his major. He should preferably, however, select his minors from subjects offered by other departments. The following list of suitable minors is intended to be suggestive rather than exhaustive or compulsory.

I. In Political Science.—(Any two acceptable for a first minor; any one, for a second minor): 1. International law and diplomacy. 2. Modern government. 3. Municipal government. 4. Constitutional and administrative law and jurisprudence. 5. Political theory.

II. In Economics and Sociology.—(Any two acceptable for a first minor; any one, for a second minor): 1. Economic history. 2. Economic theory. 3. Public and private finance. 4. Social reform. 5. Principles of sociology.

III. In Philosophy and Education.—(Any two acceptable for a first minor; any one, for a second minor): 1. History of ancient and medieval philosophy. 2. History of modern philosophy. 3. History of education.

IV. In Literature.—Some division of the history of literature which may be either comparative literature of a limited period or the literature of a particular country for a more extended period as may be agreed upon in each case.

Courses for Graduates

101. Seminar in American History.—Bibliography; practise in the solution of typical problems; reports on the progress of individual investigations by instructors and students. *Two hours, once a week; both semesters. One to two units.* Professor GREENE and others

In connection with this course, advice and direction in research are offered in various fields as follows:

A. American history before 1815. Professor GREENE

B. American history since 1815.
Professor ROBERTSON, Assistant Professor ————

C. The history of the West. Assistant Professor PEASE

D. American church history. Professor GREENE

E. Latin-American history. Professor ROBERTSON

102. Studies in English History.—Church and state in the medieval and early modern period; examination of documentary materials. *Arrange hours; both semesters. One unit.* Professor LARSON

103. Historiography and Historical Method.—The technic of historical investigation. Required of all candidates for an advanced degree in history who do not present evidence of similar training elsewhere. *Twice a week; first semester. One-half unit.* Assistant Professor ————

104. Seminar in English and Continental European History.—European expansion. Bibliography, historiography, and selected problems; reports. *Two hours, once a week; both semesters. One to two units.*
Professor LARSON, Professor LYBYER, Assistant Professor JONES

In connection with this course, advice and direction in research in various fields are offered as follows:

A. Medieval history. Professor LARSON

B. Modern history of continental Europe. Professor LYBYER

C. English history. Professor LARSON

D. Renaissance and Reformation. Assistant Professor JONES

E. Asiatic Relations. Professor GREENE, Professor LYBYER

111. Spanish-American Relations.—The relations of the Latin-American states with Europe and the United States; the Monroe doctrine; the development of international trade, etc. *Once a week; both semesters. One-half to one unit.* Professor ROBERTSON

112. Studies in American Religious History.—Questions of Church and State. *Twice a week; second semester. One unit.* (Not given, 1920-21.)
Professor Greene

150. Research in Oriental History.—*Both semesters. One unit.*
Professor Olmstead

Courses for Graduates and Advanced Undergraduates

4a-4b. Constitutional History of England.—Institutional origins; modern constitutional practise. *Three times a week; both semesters.*
Professor Larson

9a-9b. European Society in the Era of the Renaissance and the Reformation.—The transition from medieval to modern ideals. *Twice a week; both semesters.* Assistant Professor Jones

12. Medieval Civilization.—A study of intellectual conditions and movements in the Middle Ages. *Twice a week; first semester.* Professor Larson

13. The American Revolution, 1760-1783.—Colonial institutions on the eve of the Revolution; the controversy with the Mother Country; war and diplomacy; transition from provincial to republican institutions. *Three times a week; first semester.* (Not given, 1920-21.) Professor Greene

14. Studies in the Development of American Political Ideals.—*Twice a week; first semester.* Professor Greene

15. The Civil War and the Reconstruction.—The ante-bellum South and its destruction, 1844-1870. The Civil War in the light of the forces which tended to hasten or obstruct the clash of arms. *Three times a week; second semester.* Assistant Professor ————

19. French Civilization from the Age of Louis IX to the Present Time.—*Twice a week; second semester.* (Not given, 1920-21.)
Assistant Professor Jones

20a. Recent European History, 1848-1891.—The period of national consolidation and world-wide expansion. *Three times a week; first semester.* (Not given, 1920-21.) Professor Lybyer

20b. Recent European History, 1891 to Date.—The formation of alliances, the Balkan wars, and the Great War. *Three times a week; second semester.* (Not given, 1920-21.) Professor Lybyer

21. The Recent History of the United States.—Introduction to contemporary American politics. *Twice a week; first semester.*
Professor Robertson

22a-22b. The Old Northwest, 1787-1865.—The settlement of the Northwest; western economic, political, and social problems; influence of the West on national policies. *Twice a week; both semesters.*
Assistant Professor Pease

23a-23b. England in the Seventeenth and Eighteenth Centuries.—The influence of Puritanism on the institutions and ideas of England and America. English politics and political thought considered as a background to political theory in the American Revolution. *Twice a week; both semesters.*
Assistant Professor Pease

24. European Consolidation and Colonial Expansion, 1648-1789.—*Three times a week; first semester.* Professor LYBYER

25. The French Revolution, Napoleon, and the European Reaction, 1789-1848.—*Three times a week; second semester.* Professor LYBYER

(Courses 24-25 and 20a-20b will ordinarily be given in alternate years.)

26. History of the Latin-American Colonies.—The political, economic, social, and intellectual life of Spain during the period of discovery. The exploration, settlement, and civilization of Spanish America and the Philippines. *Three times a week; first semester.* Professor ROBERTSON

27. History of Latin-America from the War of Independence to the Present Time.—The national history of the leading Latin-American states with Europe and the United States. The old regime in Texas, Mexico, and California. *Three times a week; second semester.* Professor ROBERTSON

29. The Far East.—The contact of Western nations with the Far East from the Portuguese establishments of the sixteenth century to the present time, with special reference to China and Japan. *Three times a week; second semester.* (Not given in 1920-21.) Professor GREENE

30a-30b. The Ottoman Empire and the Question of the Near East.—The rise and greatness, and the beginning of the decline, of the Turkish power, 1300 to 1792. Turkey since 1792, with special attention to internal condition and international relations. *Twice a week; both semesters.* (Not given, 1920-21.) Professor LYBYER

31a-31b. The Mohammedan World.—Mohammed, the Saracen Empire, and the Moslem civilization, before the crusades. The history and culture, since the first crusade, of the Mohammedan peoples in Europe, Africa, and Asia, except the Ottoman Turks. *Twice a week; both semesters.* Professor LYBYER

40. The History of the British Commonwealth.—Conditions that led to English expansion; imperial institutions; development of the Colonial Nations. *Twice a week; first semester.* Professor LARSON

53. Assyrian History.—Sources, political thought, government of dependencies, parallels to more modern imperial states, and economic life of the Assyrian Empire. *Three times a week; second semester.* Professor OLMSTEAD

HOME ECONOMICS

This department offers graduate work along two lines, one dealing with the applications of the biological and physical sciences to the problems of food and nutrition; the other with the economic problems of the household. In either case the student must offer a minimum of ten hours' work with food, eight with textiles and clothing, five with the house, eight of chemistry, eight of biological science, and three in the principles of economics. In addition each student must offer five additional hours in economics or a second year of chemistry, including quantitative and organic chemistry, according to the line of specialization.

Courses for Graduates

101. **Home Economics.**—Vocational, educational and sociological aspects. *Twice a week; first semester. One unit.* (Not offered in 1920-21.)
Professor BEVIER

102. **Special Investigation.**—Application of the principles of bacteriology, chemistry, and physiology to the ordinary processes used in the preparation of food; problems in metabolism and nutrition. *Twice a week; both semesters. One unit.* Professor BEVIER, Miss WARDELL

103. **Seminar.**—Recent advances in nutrition. *Once a week; both semesters. One-half unit.* Miss WARDELL

104. **Economic Problems of the Family Group.**—The economic phases of selected problems of the household. *Twice a week; both semesters. One unit.* (Not given, 1920-21.)

Courses for Graduates and Advanced Undergraduates

4. **Food and Nutrition.**—Application of the principles of science to the problems of food and nutrition. *Five times a week; first semester.*
Miss WARDELL

20. **Infant Nutrition.**—*Twice a week; second semester.* Miss WARDELL

28. **Organization and Management of the Household.**—(Continuation of Home Economics 10.) The relation of the home to public activities; retail market organization; cooperative buying and housekeeping; community kitchens; laundries. *Twice a week; second semester.* (Not open to graduate students in 1920-21.)

HORTICULTURE

At least twenty hours of collegiate work in horticulture and allied subjects and specific preparation for the chosen topics are required for entrance on major work in this department.

Courses for Graduates

103. **Olericulture.**—Special problems in vegetables. *Both semesters. One to two units.* Professor LLOYD

108. **Pomology.**—Special problems in small fruits and orchard fruits. *Both semesters. One to two units.*
Professor BLAIR, Professor CRANDALL, Professor LLOYD, Professor PICKETT

115. **Floriculture.**—The horticultural status of flowering plants, or special problems in the culture of greenhouse plants. *Both semesters. One to two units.* Professor DORNER

116. **Nutrition of Greenhouse Plants.**—Lectures and special problems. *Both semesters. One unit.* Assistant Professor LEHENBAUER

Courses for Graduates and Advanced Undergraduates

8. **Orcharding.**—Pomaceous, drupaceous, and nut fruits; management of large commercial orchards. *Five times a week; first semester.*
Professor PICKETT

12. **Evolution of Horticultural Plants.**—History, botanical classification, and geographical distribution of cultivated plants; modification under culture; theoretical causes and observed factors that influence variation. *Three times a week; first semester.* Professor CRANDALL

17. **Commercial Orcharding.**—(Continuation of Horticulture 8.) Production and business methods in large orchards; reference readings; seminar. A required trip will be taken, cost not to exceed $10.00. For students specializing in pomology. *Five times a week; second semester.* Professor PICKETT

18. **Experimental Horticulture.**—Methods and difficulties in horticultural investigations; the planning of experiments; recording and interpretation of results. (For advanced students preparing for experiment station work.) *Five times a week; second semester.* Professor BLAIR, Professor PICKETT

43. **Greenhouse Fertilizers.**—Soils and fertilizers; moisture and carbon dioxide content of the air; temperature as related to greenhouse crops. *Three times a week; first semester.* Assistant Professor LEHENBAUER

44. **Pomology Seminar.**—Assigned topics; review of books, current technical journals, and other publications. For seniors and graduates specializing in pomology. *Once a week; both semesters.*
Professor PICKETT, Assistant Professor RUTH

45. **Plant Nutrition.**—Carbohydrates, proteins, organic acids, and other organic compounds of plants and their relation to plant nutrition. *Three times a week; second semester.* Assistant Professor LEHENBAUER

46. **Marketing Horticultural Products.**—Fruits and vegetables. Required inspection trip, expenses about $15.00. For seniors and graduates specializing in horticulture. *Three times a week; first semester.*
Professor LLOYD

MATHEMATICS

Students entering on graduate study with a major in mathematics must have had twenty-five semester hours of undergraduate work in mathematics, including a year's course in calculus and a course in theory of equations, or in differential equations. They should be able to read German and French.

Candidates for a doctor's degree taking a first minor in mathematics are expected to have completed a course in calculus and are required to take two one-year courses beyond the calculus; candidates for a doctor's degree taking a second minor are required to complete at least one course throughout a year beyond the calculus.

The courses offered by the department are arranged in cycles of two or of three years, so that a student will have opportunity to take any particular course offered by the department, for which he is qualified, in three years of residence required for the doctor's degree.

Courses for Graduates

100. **Seminar.**—*Three times a week; both semesters. One to two units.* Professor TOWNSEND, Professor MILLER, Professor SHAW, Professor COBLE, Professor CARMICHAEL, Associate Professor EMCH, Assistant Professor CRATHORNE, Assistant Professor KEMPNER, Assistant Professor WAHLIN

101. Functions of Real Variables.—*Three times a week; both semesters. One unit.* (Not given, 1920-21.) Professor TOWNSEND

102. Functions of a Complex Variable.—*Three times a week; both semesters. One unit.* Professor TOWNSEND

104. Theory of Aggregates.—Modern treatment of the unrestricted set, correspondence, order, limit, neighborhood, measure, etc. *Three times a week; second semester. One unit.* Assistant Professor BLUMBERG

109. Algebraic and Abelian Functions.—Algebraic functions and their integrals on the Riemann surface. Abel's theorem and the inversion problem. Multiply periodic functions. Applications to the geometry on curves. Extensions to functions of two variables and the geometry on surfaces. *Three times a week; both semesters. One unit.* Professor COBLE

110a. Elliptic Functions.—The processes of analysis on which the theory of elliptic function depends; singly periodic functions; etc. *Three times a week; first semester. One unit.* (Not given, 1920-21.)
Professor CARMICHAEL

110b. Elliptic Functions.—Approach to the theory of doubly periodic functions from the point of view of Weierstrass's product expansion, of q-difference equations, and of functional equations; etc. *Three times a week; second semester. One unit.* (Not given, 1920-21.)
Professor CARMICHAEL

111. Automorphic Functions.—Geometry in the complex plane. The group-theoretic side of the theory. Function-theoretic developments and applications of automorphic function. *Three times a week; both semesters. One unit.* (Not given, 1920-21.) Associate Professor EMCH

112a. Linear Difference Equations.—Elementary theory of differences; equations with constant coefficients; etc. *Three times a week; first semester. One unit.* Professor CARMICHAEL

112b. Linear Difference Equations.—General expansion problems. *Three times a week; second semester. One unit.* Professor CARMICHAEL

113. Linear Differential Equations in Real Variables.—General existence theorems; oscillation theorems and pendulum problems; etc. *Three times a week; first semester. One unit.* (Not given, 1920-21.)
Professor CARMICHAEL

114. Linear Differential Equations in Complex Variables.—General existence theorems, function-theoretic considerations; etc. *Three times a week; second semester. One unit.* (Not given, 1920-21.)
Professor CARMICHAEL

122. Modern Algebra.—Theory of matrices, systems of linear equations, bilinear and quadratic forms, properties of polynomials, algebraic invariants. *Three times a week; both semesters. One unit.* (Not given, 1920-21.)
Assistant Professor KEMPNER

124. The Theory of Numbers.—First semester: Theory of congruences, power residues with special study of quadratic residues and the law of reciprocity, and higher congruences. Second semester: Theory of algebraic numbers, domains of rationality, the theory of ideals. *Three times a week; both semesters. One unit.* Assistant Professor WAHLIN

126. Theory of Groups.—Introductory course. Substitution groups of low order, Sylow's theorem, etc. *Three times a week; both semesters. One unit.* Professor MILLER

127. Theory of Groups.—Advanced course. *Three times a week; both semesters. One unit.* (Not given, 1920-21.) Professor MILLER

129. Theory of Statistics.—General methods of statistical investigation; application to problems in economics, sociology and biology; graduation of frequency and other curves; correlation and contingency; limitations of the mathematical treatment of statistics; underlying assumptions and hypotheses. *Three times a week; both semesters. One unit.* Assistant Professor CRATHORNE

131. Algebraic Surfaces.—The applications of homogenous coordinates and the theory of invariants to geometry of three dimensions; etc. *Three times a week. One unit.* (Not given, 1920-21.) Associate Professor EMCH

132. Projective Geometry.—*Three times a week; both semesters. One unit.* (Not given, 1920-21.) Professor COBLE

133. Geometric Transformations.—Motion in a plane; perspective; collineation; correlation; polarity; inversion, quadratic transformations; in particular the Steinerian transformation. Discussion of various transformations in space. *Three times a week; first semester. One unit.* Associate Professor EMCH

134. Geometry in a Complex Field.—Geometric constructions in a complex plane; bilinear and higher algebraic transformations in a complex plane and their geometric interpretation. Geometric theory of associated point-couples, and its applications. The treatment of imaginary elements in geometry. Theory of foci. Motion in a complex plane. *Three times a week; second semester. One unit.* Associate Professor EMCH

135. Differential Geometry.—Applications of the calculus to the theory of curves and surfaces based primarily in the use of Cartesian coordinates; relation of the theory of surface to the theory of invariants of a pair of quadratic differential forms. *Three times a week; both semesters. One unit.* (Not given, 1920-21.) Professor COBLE

141. Vector Methods.—The algebras of quaternions, space and analysis, and dyadics; differentials and integrals of space; applications to mechanics, elasticity, hydrodynamics, electrodynamics, and meteorology. *Three times a week; first semester. One unit.* Professor SHAW

142. General Vectors.—The algebras applicable to space of four dimensions, and N dimensions; differential and integral operators; applications to relativity problems of kinematics, mechanics, electrodynamics; general dyadics and applications. *Three times a week; second semester. One unit.* Professor SHAW

143. Linear Algebra.—A general study of the theory of linear associative and non-associative algebras, particular consideration of the types of algebras, and their chief representatives; applications. *Three times a week; first semester. One unit.* (Not given, 1920-21.) Professor SHAW

144. General Algebra.—The general theory of combinations of elements, with a study of the main types such as associativity, commutativity, and

other limitation types; applications to the theory of infinite algebras and the theory of general operators. *Three times a week; second semester. One unit.* (Not given, 1920-21.) Professor SHAW

145. **Fundamental Functions.**—The theory of orthogonal and biorthogonal functions and expansions in terms of them, with particular study of several well-known cases; applications to the solution of differential and integral equations. *Three times a week; first semester. One unit.* (Not given, 1920-21.) Professor SHAW

146. **Functional Transformations.**—The theory of operators which transform functions into functions, particularly those related to the infinite algebras of orthogonal functions; applications to functions of lines, surfaces, etc., and to integro-differential equations; general infinite vector analysis. *Three times a week; second semester. One unit.* (Not given, 1920-21.)
Professor SHAW

Courses for Graduates and Advanced Undergraduates

10. **Theory of Equations and Determinants.**— *Three times a week; first semester.* Professor MILLER

16-17. **Differential Equations and Advanced Calculus.**—*Three times a week; both semesters.* Professor TOWNSEND

18. **Constructive and Projective Geometry.**—Methods of geometric constructions and constructive solution of problems. Approximative constructions. Discussion of possibilities of construction by ruler and compasses, by double-ruler, and instruments of higher order. Elements of inversive geometry in plane and space. Stereographic projection; isometric projection; orthographic projection; perspective; geometrical principles involved in projective processes; introduction to projective geometry. Analytic formulation of projective methods. *Three times a week; second semester. One unit.*
Associate Professor EMCH

21. **Method of Least Squares.**—*Twice a week; first semester.*
Professor STEBBINS

23. **Averages and Mathematics of Investment.**—Meaning, use, and abuse of averages; probability; annuities, insurance, and branches of science; loans and investments; evaluation of investment securities. *Three times a week; second semester.* Assistant Professor CRATHORNE

30-31. **Actuarial Theory.** — Life contingencies; construction of life tables; valuation of policies; theory of risk; distribution of surplus; workmen's compensation; investment of funds; etc. *Three times a week; both semesters.* (Not given, 1920-21.) Assistant Professor CRATHORNE

32. **History of Mathematics.**—*Twice a week; second semester.*
Dr. LYTLE

35. **Teacher's Course.**—Secondary algebra and geometry; educational value; position in course; methods of teaching; correlation; American and foreign methods; order and importance of topics; text-books; literature. *Twice a week; first semester.* Dr. LYTLE

40. Fundamental Concepts of Mathematics.—Development of the number concept; concepts of unity; aggregate, order, and correspondence; irrationals and limits, transcendence of e and π; etc. *Twice a week; second semester.* (Not given, 1920-21.) Dr. Lytle

MECHANICAL ENGINEERING

The prerequisite for graduate work in mechanical engineering is the equivalent of the undergraduate course required for the degree of Bachelor of Science in mechanical engineering in the branches of the subject in which registration is desired.

Courses for Graduates*

107. Thermodynamics and Heat Motors.—General theory of thermodynamics with applications. *Twice a week; both semesters. One unit.* Professor Goodenough

109. Machine Design.—Rational design; mechanics of materials. Individual problems. *Twice a week; either semester. One unit.* Professor Leutwiler

112. Laboratory Investigations.—Combustion of fuels, boiler economy, steam engines and turbines, and similar subjects. *Three times a week; both semesters. One and one-half units.* Professor Willard

MECHANICS, THEORETICAL AND APPLIED

The prerequisite for the courses for graduates in theoretical and applied mechanics is the equivalent of the undergraduate courses in theoretical and applied mechanics and in allied engineering subjects required for the degree of Bachelor of Science in engineering.

Courses for Graduates

101. Analytical Mechanics.—The historical development of methods of analysis; advanced problems in statics and dynamics; a comparative study of texts. *Twice a week; first semester. One unit.* Professor Moore

102. Resistance of Materials.—Analysis and investigation in mechanics of materials; the properties of materials used in engineering construction and the methods of determining these properties. *Twice a week; second semester. One unit.* Professor Moore

103. Hydraulics and Hydraulic Engineering.—The laws of hydraulics, and their application to engineering problems; hydraulic power and its development; design and investigation. *Twice a week; second semester. One-half to one unit.* Professor Enger

104. Experimental Work in Laboratory of Applied Mechanics.—(a) Laboratory investigation in the materials-testing laboratory; (b) experimental work in hydraulic laboratory. *Twice a week; both semesters. One-half to two units.* Professor Talbot, Professor Moore, Professor Enger

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*Courses offered to Junior and Senior students are open for minor credit to students majoring in other departments.

105. Experimental and Analytical Work in Reinforced Concrete.—Research; interpretation of experimental results and their application to the design of structures; principles of construction. *Twice a week; both semesters. One to two units.* Professor TALBOT

Courses for Graduates and Advanced Undergraduates*

1. Analytical Mechanics.—Arranged for graduates and advanced undergraduates in Arts and Sciences. *Three times a week; first semester.* Mr. ENSIGN

2. Analytical Mechanics.—A continuation of Theoretical and Applied Mechanics 1. *Three times a week; second semester.* Mr. ENSIGN

41. Advanced Mechanics of Materials.—Special problems met in engineering. Thick cylinders, guns, curved beams, hooks, chain links, rings, unsymmetrical bending, flat plates, bulkheads; elastic strength of material as affected by heat treatment and over-strain; stresses due to impact loads; resistance of materials to repeated loading; collapsing pressure of thin-walled vessels. Exact versus approximate analyses. Methods of extending approximate analyses. General methods of attack. The application of mechanics to special machine parts and structures. *Three times a week; first semester.* Associate Professor SEELY

42. The Properties of Engineering Materials; Specifications and Inspection.—The properties and uses of materials of construction, iron, steel, non-ferrous metals, wood, concrete, brick, and stone. Standard specifications for materials; methods of inspection. *Twice a week; second semester.* Professor MOORE

44. Laboratory Work in Testing Materials.—Study of testing machines and strain measuring apparatus; practise in making standard tests in tension, compression, and flexure. Torsion tests, impact tests, hardiness tests, repeated stress tests, and tests of special forms. Systematic tabulation and reduction of test data. Laboratory and computing room periods. This course is planned to serve those who wish to take positions in testing laboratories of the Government or of manufacturers. *Three times a week; second semester.* Professor MOORE

45. Advanced Technical Mechanics.—A survey of graphical and algebraic methods and principles used in technical elastostatics. Graphostatical methods; string polygons; conjugate beams; graphical treatments of continuous beams; ellipses and circles of inertia, stress rigidity, and elasticity; stress and displacement diagrams. General theories of deformation of structures in particular of statically indeterminate structures; principles of virtual work and of least action; the method of the substitute structure; the method of the principal displacements, including the slope-deflection method; Ritz's method; elastic stability and buckling. Applications to a variety of structures in different fields of engineering. *Three times a week; first semester.* Dr. WESTERGAARD

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*Courses offered to Junior and Senior students are open for minor credit to students majoring in other departments.

METEOROLOGY

(See Geology)

MINERALOGY

(See Geology)

MINING ENGINEERING

The prerequisite for graduate work in mining engineering is the equivalent of the undergraduate courses required for the degree of Bachelor of Science in mining in the branches of the subject in which registration is desired.

In addition to the regular University laboratories, the laboratory connected with the investigation of mining conditions in Illinois now being carried on jointly by the Engineering Experiment Station through the Department of Mining Engineering, the State Geological Survey, and the United States Bureau of Mines, is available for graduate instruction.

Courses for Graduates

Note.—Of courses 103, 105, only one will be given, according to election of students.

100. Seminar.—*Once a week; both semesters. One unit.*
Professor Stoek

101. Advanced Mining Methods.—Coal and ore fields of the United States; methods and economics of mining; utilization, marketing, storage, and transportation of coal and ores. *Twice a week; both semesters. One unit.*
Professor Stoek

102. Advanced Preparation of Coal and Ores.—Detailed investigation and discussion of settling ratios; laws of crushing, sorting vs. sizing; specific mill and washing problems. *Twice a week; both semesters. One unit.*
Assistant Professor ————

103. History of Miners' Organizations.—*Twice a week; both semesters. One unit.* (Not given, 1920-21.) Professor Stoek

104. Mining Reports.—Law of the apex, the classification of coal and ore lands; conservation of mineral resources; mine examination and report. *Twice a week; both semesters. One unit.* Professor Stoek

105. Welfare Work and Education Among Mine Employees.—The organization and operation of mining institutes, night classes, welfare, mine rescue, and first-aid work. *Twice a week; both semesters. One unit.*
Professor Stoek

MUNICIPAL AND SANITARY ENGINEERING

The prerequisite for graduate work in municipal and sanitary engineering is the equivalent of the undergraduate courses required for the degree of Bachelor of Science in municipal and sanitary engineering in the branches of the subject in which registration is desired.

Courses for Graduates

102. Water Supply Engineering.—Advanced work arranged to suit the requirements of individual classes. *One to three times a week; first or second semester. One unit.* Professor ENGER

103. Sewerage.—General sewerage design and construction; sewerage system; hydraulics of sewers. *Once or twice a week; second semester. One unit.* Professor ENGER

106. Water Purification, Sewage Disposal, and General Sanitation.—Design, construction, and operation of water purification plants and of sewage disposal works; water filters, sewage tanks, etc.; garbage disposal and general sanitation. *Once a week; second semester. Half unit or more.*

Professor TALBOT

Course for Graduates and Advanced Undergraduates*

6a-6b. Water Purification, Sewage Disposal, and General Sanitation.—Impurities in water supplies and methods and processes of removal; sewage disposal; purification plants; garbage collection and disposal; sanitary restrictions and regulations and general sanitation. *Three times a week; first semester. Twice a week; second semester.*

Professor TALBOT, Assistant Professor BABBITT

ORIENTAL LANGUAGES AND LITERATURES

Courses for Graduates and Advanced Undergraduates

1. Elementary Hebrew.—Grammar and reading. The Book of Genesis. *Three times a week; both semesters.* Professor OLMSTEAD

2. Advanced Hebrew.—Readings in the sources for the early history. *Twice a week; both semesters.* (Not given, 1920-21.) Professor OLMSTEAD

10. Elementary Assyrian.—Grammar, sign lists, and reading. *Three times a week; both semesters.* Professor OLMSTEAD

PALEONTOLOGY

(See Geology)

PHILOLOGY

(See **Comparative Philology**, and **Romance Philology** under **Romance Languages**)

PHILOSOPHY

Students entering on graduate work in philosophy must have had a general course in the history of philosophy, a course in logic, and a general course in psychology.

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*Other courses offered Senior students are open for minor credit to students majoring in other departments.

Courses for Graduates

103. Seminar in Ethics.—British ethics from Hobbes to Sidgwick. *Twice a week; second semester. One unit.* (Not given, 1920-21.)
Professor Daniels

107a-107b-107c. History of Philosophy.—(a) Plato and Aristotle. *Twice a week; first semester. One unit.* Professor Daniels

(b) Descartes, Spinoza, and Leibnitz. *Twice a week; first semester. One unit.*

(c) Kant and Schopenhauer. *Twice a week; second semester. One unit.*

(The subjects in 1920-21 will be determined by the needs of the students registered.)

108a-108b-108c. Seminar in Contemporary Philosophy.—(a) Idealism. *Twice a week; both semesters. One unit.* Professor Bode

(b) Realism and pragmatism. *Twice a week; both semesters. One unit.*

(c) The philosophy of Bergson. *Twice a week; both semesters. One unit.*

(The subjects in 1920-21 will be determined by the needs of the students registered.)

Courses for Graduates and Advanced Undergraduates

3 History of Ancient and Medieval Philosophy.—*Three times a week; first semester.* Professor Daniels

4. History of Modern Philosophy.—*Three times a week; second semester.* Professor Daniels

5. Political Philosophy.—A study of significant theories of the state, ancient, medieval, and modern; state sovereignty and morality with special reference to international relations. *Three times a week; second semester.* (Not given, 1920-21.) Professor Daniels

7. Ethics.—The beginning and growth of morality; ethical theory; social and economic problems of the present. *Three times a week; second semester.* Professor Daniels

9. Political and Social Ethics.—A study of the standards and principles of human conduct in political and social relations. Rights and duties of the state and the citizen. International morality. *Three times a week; first semester.* Professor Daniels

11. Philosophy of Religion.—Among the topics considered are: God; revelation; inspiration; dogma; prayer; faith; immortality; the problem of evil; the relation of morality and religion. *Twice a week; second semester.* (Not given, 1920-21.) Professor Daniels

15. British Philosophers of the Eighteenth Century.—Locke, Berkeley, and Hume. *Three times a week; first semester.* Professor Bode

16. Philosophy of Pragmatism.—*Three times a week; second semester.*
Professor Bode

PHYSICS

The prerequisite for graduate work in physics is a college course in general physics with a year's laboratory course in introductory physical measurements. The student who is to do major work in physics should also have had addi-

tional courses in physics or teaching experience, unless the training in his minor subjects, mathematics or chemistry, has been strong and complete. He should also have a knowledge of French and German sufficient to use references in these languages. The courses named below are those open for candidates for the master's or doctor's degree. A large part of the last year's work of the candidate for the doctor's degree is investigational, along either the experimental or the theoretical side of physics. In addition to these major graduate courses, the courses in elementary dynamics, heat, light, electrical measurements, and introductory electrical theory are arranged with certain additions for the graduate credit. The intermediate courses on electricity and magnetism, heat, and light (Physics 15, 16, 17) may be offered with certain additions by candidates for the master's degree and then generally only as minors.

Courses for Graduates

104a-104b. Selected Problems in Electrical Measurements.—(a) Measurement of high and low resistances by refined methods; aperiodic and ballistic galvanometers; damping factor and critical damping resistance of a galvanometer; electric current and quantity; absolute determination of capacity; the Dolezalek quadrant electrometer; properties of dielectrics; the measurement of v and e—m for cathode rays; positive electricity; the potentiometer. (b) Refined methods of measuring the magnetic properties of iron; plotting of hysteresis curves and the determination of hysteresis losses; the Siemens electrodynomometer; the measurement of self- and mutual-induction by various methods including Hughes induction balance; the Braun discharge tubes in magnetic hysteresis; and the study of the characteristics of various forms of discharge tubes in the detection and amplification of electric waves. *Two times a week of three hours each; both semesters. Three-fourths unit.* (Course 104a is recommended for graduate students in chemistry.) Professor Knipp

121. Recent Advances in Physics and the Electron Theory.—A series of demonstration lectures, in which members of the class will take turns in preparing and presenting experiments. The universal occurrence of electrons; properties of the electron, and of the gaseous ion; determination of e/m and v of the electron, and of the ion; use of positive rays (kanalstrahlen) in gas analysis; color effects of electrons, of ions, and of retrograde rays in residual hydrogen and helium; determination of the elementary charge of the electron. Once a fortnight; this will be in conjunction with 124. *Second semester. One-fourth unit.* Professor Knipp

123. Sound.—Advanced course on theory and experiments dealing with the production, transmission, and reception of sound. *Twice a week; both semesters. Either three-fourths unit or one unit* each semester.

Professor Watson

124. Conduction of Electricity Through Gases.—A critical study of the phenomena of the conduction of electricity through gases. Lectures, recitations, and laboratory. Selected chapters from Townsend's *Electricity in Gases* and other texts. *Three times a week; first and second semesters. One unit.*

Professor Knipp

126. **Physics Colloquium.**—Weekly meetings of the instructors and advanced students of the department for the presentation and discussion of papers on current problems in physics. Attendance is expected of all the graduate students. *Once a week; both semesters. No credit.*

131. **Investigation of Special Problems.**—*Two to four times a week; both semesters. One to two units.* Professors CARMAN, KNIPP, WATSON, Associate Professor KUNZ, Assistant Professors SCHULZ, WILLIAMS

132. **Mathematical Physics.**—The complete list of courses in theoretical physics for 1920-21 will not be ready for announcement until September, 1920. Students wishing such courses should get a list of additional courses at the time of registration.

132a. **Dynamics.**—Lectures on dynamics, special attention being paid to the general principles of dynamics, such as the principle of least action. Special problems are discussed, such as gyroscopic motion, the case of three attracting bodies, etc. The second part of the course will be devoted to hydrodynamics and aerodynamics. (Not given in 1920-21.)

Associate Professor KUNZ

132b. **Electrodynamics.**—The potential theory applied to electrical and magnetic polarization; spherical harmonics, images and inversion, conjugate functions, elliptic coordinates and integrals, magnetic actions of currents, determination of coefficients of capacity, self and mutual induction, absolute measurements, Maxwell's theory with some applications in optics. *Four times a week; both semesters. One unit.* (Not given, 1920-21.)

Associate Professor KUNZ

132d. **Electric Oscillations.**—Maxwell's theory of the electromagnetic field. Electric oscillations along single and parallel wires; Hertz's oscillator; theory of the antennal propagation of waves over the surface of the earth; absorption; reflection, diffraction and scattering of electric and light waves. From the mathematical point of view, this course may be considered as an application of the potential theory involving spherical and cylindrical harmonics. *Twice a week; first semester. Three-fourths unit.* (Not given, 1920-21.)

Associate Professor KUNZ

132e. **Thermodynamics.**—*Twice a week; second semester. One unit.*

Professor GOODENOUGH

133. **Seminar.**—*Three or five times a week; both semesters. One to three units.* Professors CARMAN, KNIPP, WATSON, Associate Professor KUNZ, Assistant Professor SCHULZ

Courses for Graduates and Advanced Undergraduates

44a-44b. **Electrical and Magnetic Measurements.**—A comprehensive course in exact electrical and magnetic measurements, adapted for general and technical students. *Twice a week; both semesters.* Professor KNIPP

44a-44b. **Electrical and Magnetic Measurements.**—(Special section for graduate students of chemistry during the first semester.) *Twice a week; both semesters.* Professor KNIPP

14a. **Introduction to Theoretical Physics.**—Dynamics. Motion, mass, and force; problems from pure and applied physics. *Three times a week; first semester.* Professor CARMAN

*15. **Electricity and Magnetism.**—(Recommended to students in non-technical courses who wish a knowledge of electricity and magnetism beyond the course in general physics.) *Two recitations or lectures and one three-hour laboratory exercise weekly; first semester.* Professor KNIPP

*16. **Heat.**—Fundamental heat phenomena, the mechanical theory of heat, and elementary thermodynamics. Thermometry, calorimetry, vapor pressure, expansion of bodies, transmission of heat, mechanical equivalent. *Three times a week; second semester.* Professor WATSON

*17. **Light.**—Reflection, refraction, interference, diffraction, and polarization; telescopes, microscopes, refractometers, prism and grating spectroscopes, and interferometers. *Three times a week; first semester.* Assistant Professor SCHULZ

20. **Light.**—Special phenomena; modern theories; readings in Drude, Week, and Preston. *Twice a week; second semester.* Assistant Professor SCHULZ

22. **Advanced Light Measurements.**—Wave length determinations with gratings, echelons, and interferometers; spectroscopic work; Zeeman effect; polarimetric analysis; determination of resolving power of instruments; photometry and spectrophotometry. *Twice a week; second semester.* Assistant Professor SCHULZ

23. **Sound.**—Origin, propagation, velocity, and interference of sound; vibration of strings, rods, and gas columns; physical theory of music and speech. *Three times a week; first semester.* Professor WATSON

24. **Properties of Matter.**—Weight; mass; gravitation; elasticity; viscosity; surface tension; diffusion. Measurements including the use of the dividing engine, chronograph, etc. *Twice a week; second semester.* Assistant Professor WILLIAMS

27. **Fundamental Physical Measurements.**—An advanced laboratory course in measurements of length, mass, time and of determinations of gravitation, elasticity, surface tension, viscosity, etc. *Once or twice a week; second semester. One-half or one unit.* Assistant Professor WILLIAMS

30. **Introduction to Theoretical Electricity.**—Electrical and magnetic phenomena discussed with calculus methods. (For advanced students in physics, chemistry, mathematics, and engineering.) *Three times a week; second semester.* Professor KNIPP

33. **Sound.**—Laboratory experiments in fundamental phenomena in sound. The theory of sound as given in Physics 23 may be taken profitably with this course. *Once a week; first semester.* Professor WATSON

PHYSIOGRAPHY

(See **Geology**)

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*These courses may be taken for a minor credit or as *first* year major credit only.

PHYSIOLOGY

The prerequisites for graduate work in physiology are physiology 10 and 10a.

Courses for Graduates

100. **Advanced Work in the Physiology** of secretion, digestion, absorption, metabolism, excretion, and glands of internal secretion. *Five times a week; either semester. One to two units.* Assistant Professor BURGE

101. **Journal Club.**—Review of literature. *Once a week; both semesters. One-fourth to one unit.* Members of the staff

102. **Research.**—*Three times a week; both semesters. One to two units.* Members of the staff

Courses for Graduates and Advanced Undergraduates

5. **Physiology of Nutrition.**—Utilization of food material by the body in health under various conditions and in disease. *Twice a week; second semester.* Assistant Professor BURGE, Assistant ————

7. **Physiology of the Special Senses.**—*Twice a week; second semester.* Assistant Professor BURGE, Assistant ————

POLITICAL SCIENCE

Graduate work in political science is conducted in the following special fields: (1) Political theory; (2) international law and diplomacy; (3) modern government; (4) constitutional law, administrative law, and jurisprudence; (5) municipal administration.

To be admitted to take political science as a major subject, the student must have done at least 18 hours of undergraduate work in political science, economics, and history, not less than nine hours of which must have been in political science. To take political science as a minor he must have had at least nine hours' work in these fields, including six hours in political science.

If a student making political science his major is taking both of his minors in other departments, one of them must be in history, economics, or sociology.

Several courses given in other departments are so closely related to those in political science that graduate students whose major is political science may be permitted on petition to take such courses as part of their major work. Attention is also called to the technical courses given by the department of municipal and sanitary engineering.

Courses for Graduates

101. **History of Political Theories.**—Political theories of Aristotle, Machiavelli, Hobbes, Locke, Montesquieu, Rousseau, and others; evolution of American political ideas. *Twice a week; first semester. One unit.* (Not given, 1920-21.) Professor GARNER

102. **The Nature of the State.**—Principles, methods, and nature of political science; the origin, attributes, forms, and functions of the state; sovereignty and liberty; citizenship and nationality; constitutions, their nature and forms; principles of legislative, executive, and judicial organization. *Twice a week; first semester. One unit.* Professor FAIRLIE

103. Seminar in Political Science and Public Law.—Special problems; reports; discussions and criticism. The research work of candidates who are writing theses is under the direction of some instructor to whom they report frequently. *Once a week; both semesters.* Members of the department

107. Foreign Relations of the United States.—Studies in the principles and practises of American foreign policy. *Twice a week; second semester. One unit.* Associate Professor MATHEWS

112. Public Administration.—Comparative studies in national and local administration. War administration. *Twice a week; first semester. One unit.* Professor FAIRLIE

113. State Government and Administration.—Studies in the organization and methods of state governments in formulating and executing public policies. *Once a week; second semester. One unit.* (Not given, 1920-21.) Associate Professor MATHEWS

Courses for Graduates and Advanced Undergraduates

4. Municipal Government.—*Three times a week; first semester.* Assistant Professor STORY

5. Constitutional Law of the United States.—*Three times a week; first semester.* Associate Professor MATHEWS

6. International Law.—*Three times a week; first semester.* Dr. BERDAHL

7. American Diplomacy.—*Three times a week; second semester.* Associate Professor MATHEWS

9. Principles of Jurisprudence.—The nature and sources of law; historical development and comparison of Roman law and the English legal system; English common law in the United States; relation between statutes and judicial decisions; classification of law. *Twice a week; first semester.* Professor FAIRLIE

10. Administrative Law in the United States.—Administrative organization; separation of powers and delegation of legislative powers; nature and scope of administrative power; administrative procedure and methods of enforcing governmental commands; remedies of the individual against unlawful official action. *Three times a week; second semester.* (Not given, 1920-21.)

11. Constitutional Aspects of Social and Industrial Problems.—The police power; constitutional limitations on legislation concerning the public health and safety; the control of public service corporations and combinations of capital and labor. *Three times a week; second semester.* Assistant Professor STORY

12. National Administration in the United States.—The President and the Cabinet; the executive departments and the administrative services of the national government; war agencies. *Three times a week; second semester.* Professor FAIRLIE

13. State Administration in the United States.—*Twice a week; first semester.* Associate Professor MATHEWS

14. **Political Parties.**—Development of political parties and their organization and influence on the government mainly in the United States and Great Britain; recent legislation on primaries and nomination methods in this country. *Twice a week; second semester.* Dr. Berdahl

18. **Legislation in the United States.**—Nature of legislative power; representation; legislative organization, procedure and practises; bill drafting; legislative reference bureaus; popular law making; tendencies in legislation. *Three times a week; second semester.* (Not given, 1920-21.)
Assistant Professor Story

22. **European Governments.**—The political systems of Great Britain, France, Germany, Italy, and Switzerland. *Three times a week; first semester.*
Professor Fairlie

28. **Problems of Contemporaneous Politics.**—*Twice a week; first semester.* (Not given, 1920-21.) Assistant Professor Story

34. **Municipal Problems.**—Municipal administration in the United States and Europe; municipal organization and relations to the state; municipal ownership and regulation of public utilities; city planning and housing; police and sanitary administration; municipal finances. *Three times a week; second semester.* Professor Fairlie

PSYCHOLOGY

Graduate students who elect psychology as their major subject must have had standard courses, of university grade, both in general psychology and in the psychological laboratory. One general university course is the minimal requirement for graduate students who apply to the department for a minor subject.

Courses for Graduates

103. **Research.**—Experimental and historical investigations. *Both semesters. One-half to two units.*
Professor Bentley, Associate Professor Ruckmick, Dr. Rahn

105. **Seminar.**—Current topics in their historical setting. *Once a week; two hours; both semesters. One unit.* Professor Bentley

Courses for Graduates and Advanced Undergraduates

5-6. **Comparative Psychology.**—Mind in the animal forms. *Twice a week; both semesters.* Dr. Rahn

9. **Physiological Psychology.**—The psychophysical relationships. *Three times a week; second semester.* Dr. Rahn

10. **Translation of Psychological Treatises.**—Reading and systematic interpretation of standard works in foreign languages. *Twice a week; first semester.* Professor Bentley

12-13. **Minor Problems.**—Methods suitable to new problems. *Three times a week; both semesters.*
Professor Bentley, Associate Professor Ruckmick, Dr. Griffith

14. **Social Psychology.**—The social mind, its factors and conditions; the psychology of peoples. *Three times a week; first semester.* Dr. Rahn

15. The Psychological Basis of Music. — Development of melody, rhythm, and harmony; auditory phenomena pertaining to music; tests of musical aptitude. *Twice a week; second semester.* Associate Professor RUCKMICK

16. Genetic Psychology.—Instinctive responses; habits; development of mental functions in the child from birth to maturity. *Twice a week; first semester.* Associate Professor RUCKMICK

17. The History of Psychology.—*Twice a week; second semester.* Dr. GRIFFITH

20. Systematic Psychology.—*Three times a week; second semester.* Professor BENTLEY

21-22. Special Studies.—Individual investigations for advanced students. *Three times a week; both semesters.* Professor BENTLEY, Associate Professor RUCKMICK, Dr. RAHN

RAILWAY ENGINEERING

The prerequisite for graduate work in railway engineering is the equivalent of the undergraduate courses required for the degree of Bachelor of Science in railway engineering in the branches of the subject in which registration is desired.

Courses for Graduates

102. Locomotive Design.—Steam pressure, compounding, superheating, etc. *Once a week; both semesters. One unit.* Professor SNODGRASS

106. Locomotive Operation.—Train resistance and locomotive tractive effort; tonnage ratings. *Once a week; both semesters. One unit.* Professor SNODGRASS

108. Electric Railways.—Design, selection, and operation of electric railway equipment. *Once a week; both semesters. One unit.* Professor ————

110. Railway Location.—Effects of the location of a railway on its earning capacity; engineering and economic problems met with in original location; relocation and reduction of grades of existing lines. *Once a week; both semesters. One unit.* Professor KING

Courses for Graduates and Advanced Undergraduates

6. Locomotives.—*Four times a week; second semester.* Professor SNODGRASS

33. Economic Theory of Railway Location.—*Four times a week; second semester.* Professor KING

64. Electric Railway Practise.—*Three times a week; first semester.* Professor ————

74. Electric Railway Economics.—*Three times a week; second semester.* Professor ————

RHETORIC

(See **English**)

ROMANCE LANGUAGES AND LITERATURES

Before entering upon the study of Romance Languages as a major for the degree of A.M., the candidate must have had at least (a) three years of college work in one Romance language, together with a satisfactory reading knowledge of another; or (b) two years of college work in each of two Romance languages. In either case a reading knowledge of German is highly desirable. Before being accepted as a recognized candidate for the degree of Ph.D., he must have had in addition satisfactory training in Latin, and must be able to read ordinary German prose. Before entering on the study of Romance languages as a first or second minor, the candidate must have had two years of college work in the language desired.

French

Courses for Graduates

101. Old French Epic Literature.—Reading and interpretation of the greater national and courtly epics; the history of these types of medieval literature. *Twice a week; both semesters. One unit.* (Not given, 1920-21.)
Professor OLIVER

102. Old French Lyric and Prose Literature.—Interpretation of the earlier Old French didactic, chronicle, and lyric writers. *Twice a week; both semesters. One unit.* (Not given, 1920-21.) Professor OLIVER

103. Seventeenth Century Prose Writers.—French culture, society, and prose literature of the seventeenth century; great preachers and moralists; Jansenism and Port Royal; formation of the classic ideals. *Once a week; both semesters. One-half unit.* (Not given, 1920-21.) Professor OLIVER

104. Eighteenth Century Prose Writers.—Society, culture, and prose literature of the eighteenth century. The attack on the classic ideals; growth of the revolutionary spirit. *Once a week; both semesters. One-half unit.*
Professor OLIVER

127. French Romanticism.—Origin and development of the Romantic movement in France. *Twice a week; both semesters. One unit.*
Professor CARNAHAN

Courses for Graduates and Advanced Undergraduates

10a-10b. General Survey of French Literature.—The main currents of French literature from the beginning to the present time. *Three times a week; both semesters.* Professor CARNAHAN

24a-24b. French Drama of the Seventeenth and Eighteenth Centuries.—Corneille, Racine, Moliere, Voltaire, Marivaux, Sedaine, Beaumarchais. *Three times a week; both semesters.* Professor OLIVER

35a-35b. French Literature of the Sixteenth Century.—Marot, Ronsard, Du Bellay, Rabelais, Montaigne, the drama. *Twice a week; both semesters.*
Professor MCKENZIE

42a-42b. The French Novel.—From 1850 to the present time. Lectures, reports, and collateral reading. *Twice a week; both semesters.* Dr. HAMILTON

Italian

Courses for Graduates

140. Italian Literature of the Thirteenth and Fourteenth Centuries.—Dante, Petrarch, Boccacio. *Twice a week; second semester. One unit.*
Professor McKenzie

143. Italian Literature of the Fifteenth and Sixteenth Centuries.—*Twice a week; first semester. One unit.* (Not given, 1920-21.)
Professor McKenzie

146. Modern Italian Literature.—Italian writers of the nineteenth century. *Twice a week; first semester. One unit.* Professor McKenzie

Course for Graduates and Advanced Undergraduates

2a-2b. Italian Literature.—Reading; composition; conversation. Introduction to Dante. *Twice a week; both semesters.* Professor McKenzie

Spanish

Courses for Graduates

132. The Novela of the Golden Age.—Political and social conditions in Spain from 1560 to 1700; the kinds of prose fiction produced in this period; *Don Quixote* and the *Novelas Exemplares* of Cervantes. *Twice a week; both semesters. One unit.* (Not given, 1920-21.) Professor Fitz-Gerald

133. Origin of the Spanish Novela and of the Comedia.—The development of Spanish prose fiction and of Spanish dramatic art for the period previous to the Golden Age. *Twice a week; both semesters. One unit.*
Professor Fitz-Gerald

134. The Spanish Ballad.—Types of the ballad. *Twice a week; both semesters. One unit.* (Not given, 1920-21.)

137. Spanish Satire.—Development of satire in Spanish literature from the earliest monuments to the present. *Twice a week; both semesters.* (Not given, 1920-21.)

139. Spanish Literature in the Middle Ages.—Lectures on the history of Spanish literature from its origin through the reign of John II on Castile. *Twice a week; both semesters. One unit.*
Professor Fitz-Gerald

Courses for Graduates and Advanced Undergraduates

10a-10b. General Survey of Spanish Literature.—*Twice a week; both semesters.* (Not given, 1920-21.)

11a-11b. Spanish Drama of the Sixteenth and Seventeenth Centuries.—Dramatists of the classical period; Lope de Vega, Calderon, Tirso de Molina, and Ruiz de Alarcon. *Twice a week; both semesters.*
Assistant Professor Van Horne

17a-17b. Spanish Drama in the Nineteenth Century.—*Twice a week; both semesters.* (Not given, 1920-21.) Assistant Professor Van Horne

42a-42b. The Modern Novel in Spain.—Development of the novel in Spain from the middle of the nineteenth century to the present. *Twice a week; both semesters.* Dr. Hamilton

Romance Philology

Courses for Graduates

171. **Introduction to Romance Philology.**—Historical phonology and morphology of the Romance languages. *Twice a week; both semesters. One unit.* (Not given, 1920-21.) Professor FITZ-GERALD

175. **Old French Phonology and Morphology.**—Development of Old French from Vulgar Latin. *Twice a week; both semesters. One unit.* Professor OLIVER

179. **Old Provencal.**—Historical grammar; selected texts. *Once a week; both semesters. One-half unit.* (Not given, 1920-21.)

181. **Origin and Formation of the Italian Language.**—Thirteenth century texts. *Twice a week; second semester. One unit.* (Not given, 1920-21.) Professor MCKENZIE

185. **Oldest Monuments of the Spanish Language; Origins of Spanish Poetry.** — Historical grammar and paleography; interpretation of texts. *Once a week; both semesters. One-half unit.* Professor FITZ-GERALD

191. **Fables and Bestiaries.**—History of animal literature, especially the medieval French and Italian collection. *Twice a week; second semester. One unit.* (Not given, 1920-21.) Professor MCKENZIE

195. **Seminar.**—Research work in preparation for theses in the field of Romance languages. *Both semesters. One unit.* Professor MCKENZIE and other members of the department

SCANDINAVIAN LANGUAGES

(See English)

SOCIOLOGY

Preparation for graduate work in sociology must include at least the equivalent of twelve semester hours in the social sciences, of which at least three must be in sociology, and three in the principles of economics. The remainder may be in any combination of these two subjects, or of history and political science.

Courses for Graduates

100. **Bases of Social Theory.**—*Twice a week; first semester. One unit.* Professor HAYES

101. **Sociological Method.**—Adaptability to sociological investigation of methods described in Pearson's *Grammar of Science,* Wundt's *Methodenlehre, zweite abtheilung,* Seignobos' *La Methode Historique Appliquee aux Sciences Sociales,* Bernheim's *Historische Methode,* Spencer's *Study of Sociology,* and Giddings' *Inductive Sociology. Three times a week; first semester. One unit.* Professor HAYES

102. **The Development of Sociology.**—*One session, two hours each week; both semesters. One unit.* Professor HAYES

150. **Seminar.**—Preparation of theses; detection and statement of problems. *One session of two hours each week; both semesters. One to two units.*
Professor HAYES

(Note: One of the three courses last described will be omitted in 1920-21; which one is omitted will depend on the election of students.)

Courses for Graduates and Advanced Undergraduates

3. **Social Evolution.**—The explanation of progressive social change, derived by applying the comparative method to ethnographic and historical materials relating to family organization, practical arts, economic wants and institutions, government and law, moral codes, and religions as they have appeared among savage, barbarous, and civilized peoples. *Three times a week; second semester.*
Professor HAYES

8. **Charities.**—The evolution of modern organized philanthropy, public and private; causes and prevention of poverty; organization and management of charitable institutions. *Three times a week; first semester.*
Assistant Professor SUTHERLAND

9. **Criminology.**—Nature, causes, and treatment of the criminal; evolution of modern methods of criminal procedure and penology; recent experiments and tendencies. *Three times a week; second semester.*
Assistant Professor SUTHERLAND

10. **Problems of Population.**—*Three times a week; first semester.*
Assistant Professor SUTHERLAND

12. **Labor Problems** (the same as **Economics 12**).—*Three times a week; both semesters.*
Associate Professor WATKINS

14. **Social Statistics.**—Social investigation and research. Social and community surveys. The verification of sociological principles by means of statistical method. *Three times a week; second semester.*
Assistant Professor SUTHERLAND

21. **Socialism and Economic Reform** (the same as **Economics 21**).—*Twice a week; second semester.*
Associate Professor WATKINS

SPANISH

(See **Romance Languages**)

ZOOLOGY

At least sixteen semester hours of college work in zoology are required for entering on major graduate study in this subject. Under special circumstances advanced work in closely allied subjects may be accepted in lieu of the fourth semester's work in zoology. When zoology is chosen for a minor the courses listed for graduates and undergraduates must be preceded by at least one full year's undergraduate work in zoology.

For the prosecution of graduate study in zoology a reading knowledge of German and French is indispensable and familiarity with Latin and Greek is of great advantage.

Every candidate for the doctor's degree is expected to spend at least one summer in study at the seashore. To facilitate this plan an investigator's room has been provided at the Woods Hole Marine Biological Laboratory, where members of the department are afforded research facilities without cost to themselves. Application for the use of this room should be made to the head of the department early in the year. Similar facilities are afforded at the Harpswell Marine Laboratory.

Courses for Graduates

102. **Selected Topics from Vertebrate Morphology.**—Origin of vertebrates and of the different classes; segmentation of the head; morphology of special systems. *Twice a week; first semester. One-half unit.*
Professor Kingsley

107. **Parasitology.**—Structure and life history of animal parasites; their relations to disease; origin and biological significance of parasitism. *Second semester. One unit each.* (Given in 1920-21 and in alternate years.)
Professor Ward

109-109a. **Physiological Ecology.**—The regulatory mechanism of organisms; neutrality, osmotic pressure, immunity, and temperature in relation to natural environment. 109 *twice a week;* 109a assigned readings and reports. *Second semester. One-half unit each.* (Given in 1920-21 and in alternate years.)
Assistant Professor Shelford

[110-110a. **Economic Ecology.**—Application of principles of physiology and ecology to problems of fisheries and pollution; quantity and weather; forestry and conservation. 110 *twice a week;* 110a assigned reading and reports *Second semester. One-half unit each.* (Given in 1919-20 and in alternate years.)]
Assistant Professor Shelford

111. **Experimental Ecology.**—Repetition of published experiments in physiology and ecology, and study of modern methods and apparatus. *Both semesters. One-half to two units.*
Assistant Professor Shelford

115. **Factors of Individual and Racial Development.** — Experimental embryology; regeneration; heredity; variation; evolution. *Twice a week; both semesters. One unit.*
Professor Zeleny

117. **Faunistic Zoology.**—Taxonomy and distribution, with especial reference to the local fauna; laboratory and field work. *Three times a week; first semester. One unit.*
Professor Smith

[127. **Theories of Animal Phylogeny.**—Relations of various groups of animals; signification of so-called intermediate forms; invertebrate larval forms and theories of descent based on them. *Once or twice a week; both semesters. One unit.* (Given in 1919-20, and in alternate years.)]
Professor Ward

Individual Research Courses

121. **Invertebrate Morphology and Parasitology.**—*One to two units.*
Professor Ward

122. **Vertebrate Morphology.**—*One to two units.* Professor Kingsley

123. **Faunistic and Systematic Zoology.**—*One to two units.* Professor SMITH

124. **Experimental Zoology.**—*One to two units.* Professor ZELENY

125. **Animal Ecology and Behavior.**—*One to two units.* Assistant Professor SHELFORD

Courses for Graduates and Advanced Undergraduates

8a-8b. **Thesis Investigation.**—Individual work on assigned topics. *Both semesters.* Various instructors

11. **Experimental Ecology and Geography.**—The physiology of environmental relations, facts, principles, and methods of analysis of behavior. World and regional aspects of behavior and ecology including animal distribution as related to climate and vegetation. Assigned readings and map making. *Two or four times a week; first semester.* Assistant Professor SHELFORD

20a-20b. **Current Investigations.**—A critical analysis of the results of recent zoological investigations. (Must be taken by all graduate students majoring in Zoology.) *Once a week; both semesters.* Professor ZELENY

21a-21b. **Introduction to Zoological Research.**—Morphology, life-history, or reciprocal relations of invertebrate animals, especially parasitic forms. *Two to five times a week; both semesters.* Professor WARD

22-23. **Morphology of Vertebrates.**—Detailed studies of systems of organs from the comparative standpoint. *Two to five times a week; both semesters.* Professor KINGSLEY

25-26. **Experimental Zoology.**—Experimental embryology; regeneration; heredity; variation; evolution. *Two to five times a week; both semesters.* Professor ZELENY

63. **Ontogeny of Vertebrates.**—Comparative studies of germ layers and early organogeny, with graphic and plastic reconstructions. Based chiefly upon Elasmobranchs and Amphibians. Open to seniors and graduates. *Twice a week; first semester.* Professor KINGSLEY

66. **Ontogeny of Vertebrates.**—Studies of the development of selected systems of organs. Open to seniors and graduates. *Three times a week; second semester.* Professor KINGSLEY

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UNIVERSITY OF ILLINOIS BULLETIN

ISSUED WEEKLY

VOL. XIX SEPTEMBER 12, 1921 NO. 2

[Entered as second-class matter December 11, 1912, at the post office at Urbana, Illinois, under the act of August 24, 1912. Acceptance for mailing at the special rate of postage provided for in section 1103, Act of October 3, 1917, authorized July 31, 1918]

THE GRADUATE SCHOOL

OF THE

UNIVERSITY OF ILLINOIS

1921-1922

PUBLISHED BY THE UNIVERSITY OF ILLINOIS
URBANA

THE UNIVERSITY OF ILLINOIS

THE STATE UNIVERSITY

THE UNIVERSITY INCLUDES

The Graduate School, which offers courses of graduate study in all departments of the University.

The College of Liberal Arts and Sciences.

The College of Commerce and Business Administration.

The College of Engineering and the Engineering Experiment Station.

The College of Agriculture and the Agricultural Experiment Station.

The College of Law.

The College of Education.

The College of Medicine (Chicago).

The College of Dentistry (Chicago).

The Schools of Music, Library Science, and Pharmacy (Chicago).

The Summer Session of eight weeks, held each summer.

The State Laboratory of Natural History, the State Geological Survey, the State Water Survey, located at the University, all offer unusual facilities for research.

The Libraries at Urbana contain 456,503 volumes and 52,041 pamphlets.

For catalogs and information address

The University Registrar,
Urbana, Illinois.

THE GRADUATE SCHOOL

OF THE

UNIVERSITY OF ILLINOIS

Announcement for
1921-1922

PUBLISHED BY THE UNIVERSITY OF ILLINOIS
URBANA

Rogers Printing Company
Dixon, and Chicago, Illinois

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The Governor of Illinois ..... *Ex Officio*
LEN SMALL ..... Springfield

The Superintendent of Public Instruction ..... *Ex Officio*
FRANCIS G. BLAIR ..... Springfield

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Mary E. Busey, Urbana	1923
John M. Herbert, Murphysboro	1925
Cairo A. Trimble, Princeton	1925
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THE UNIVERSITY CALENDAR
1921-1922

As Applicable to the Graduate School

First Semester, 1921-1922

1921

Sept. 19, 20, Monday, Tuesday	Registration days
Sept. 21, Wednesday, 8 a. m.	Instruction begun
Nov. 7, Monday, 5 p. m.	Latest day for announcement of subjects for graduate theses
Nov. 24, Thursday	Thanksgiving Day
Dec. 3, Saturday	Illinois Day
Dec. 22, Thursday, 11 a. m.	Holiday recess begun
Dec. 31, Saturday, 5 p. m.	Latest day for submission of outlines of theses by candidates for professional degrees in engineering.

1922

Jan. 3, Tuesday, 1 p. m.	Instruction resumed
Jan. 21, Saturday	Semester examinations begun
Feb. 1, Wednesday	Semester examinations ended

Second Semester, 1921-1922

Feb. 6, 7, Monday, Tuesday	Registration days
Feb. 8, Wednesday, 8 a. m.	Instruction begun
Feb. 12, Sunday	Lincoln Day
April 1, Saturday, 5 p. m.	Latest day for filing of completed theses by candidates for professional degrees in engineering
April 13, Thursday, 11 a. m.	Easter Recess begun
April 18, Tuesday, 1 p. m.	Instruction resumed
May 3, Saturday, 12 m.	Latest day for receipt by the Dean of the Graduate School of certified copies of doctors' theses
May 27, Saturday	Final examinations begun
June 3, Saturday, 12 m.	Latest day for receipt by the Dean of the Graduate School of certified copies of masters' theses
June 7, Wednesday	Final examinations ended
June 11, Sunday	Baccalaureate address
June 13, Tuesday	Alumni Day
June 14, Wednesday	Fifty-first Annual Commencement

THE EXECUTIVE FACULTY

David Kinley, Ph.D., LL.D., *President*

Arthur Hill Daniels, Ph.D., *Professor of Philosophy and Dean of Graduate School*
William Leonidas Burlison, Ph.D., *Professor of Crop Production*
Edward Herbert Cameron, Ph.D., *Professor of Educational Psychology*
Albert Pruden Carman, A.M., D.Sc., *Professor of Physics*
Julius Goebel, Ph.D., *Professor of Germanic Languages*
Laurence Marcellus Larson, Ph.D., *Professor of History*
Herbert Windsor Mumford, B.S., *Professor of Animal Husbandry*
William Albert Noyes, Ph.D., LL.D., *Professor of Chemistry*
William Abbott Oldfather, Ph.D., *Professor of Classics*
Stuart Pratt Sherman, Ph.D., *Professor of English*
Arthur Newell Talbot, C.E., D.Sc., D. Eng., *Professor of Municipal and Sanitary Engineering*
Edgar Jerome Townsend, Ph.D., LL.D., *Professor of Mathematics*
Henry Baldwin Ward, Ph.D., D.Sc., *Professor of Zoology*
Edward Wight Washburn, Ph.D., *Professor of Ceramic Chemistry*

HISTORY AND ORGANIZATION

The University of Illinois offered facilities for advanced study and research in various lines as early as 1872. Organized graduate instruction, however, under the name of the Graduate School, was first undertaken in 1892. In 1894 the administration of the school was vested in the Council of Administration, and the Vice-President of the University became Dean of the School. In 1906 the Graduate School was organized as a separate faculty, consisting of a dean and members of the University faculty assigned to this duty by the President.

By action of the Trustees the teaching faculty of the Graduate School includes all members of the University faculty who give instruction in approved graduate courses. The affairs of the School, however, are in charge of the Executive Faculty appointed each year by the President.

ADMISSION

Admission to the Graduate School may be granted to graduates of institutions whose requirements for the bachelor's degree are substantially equivalent to those of the University of Illinois, and to applicants from other institutions approved by the Executive Faculty, as hereinafter provided. *Admission to the Graduate School does not, however, imply admission to candidacy for an advanced degree, and gives no right or claim to be so admitted. Such candidacy is determined by the Faculty after the student has demonstrated by his work here, for from two to five months, that he has the ability to do major work of graduate character. A mere accumulation of "credits" or "grades" is not sufficient.*

A graduate of an institution meeting the requirements of a standard college as described below, may be admitted to the Graduate School, provided he satisfies the Dean and the departments concerned that he will be able to proceed to the master's degree in a period not exceeding two years.

For the purposes of admission to the Graduate School a *standard college* is one which meets the following requirements:

1. An enrollment of not fewer than one hundred students of college grade, with an average for a series of years of at least twenty-five per cent registered in the junior and senior classes.

2. A graduation requirement of four years (120 semester hours) of collegiate grade.

3. A minimum entrance requirement of 14 units. By the minimum requirement is meant the smallest number of units with which a student may be permitted to begin college work, i. e., the nominal requirement minus the number of units of conditions allowed.

4. A requirement that all entrance conditions must be removed before a student may be permitted to begin a second year of work in the same institution.

5. Not less than eight distinct departments in liberal arts and sciences, with at least one professor giving full time to college work in each department.

6. A minimum educational attainment of all college teachers of academic subjects equivalent to graduation from a college of high grade and graduate work equal to that required for the master's degree at the University of Illinois.

7. A maximum of 16 semester hours per week required of college teachers.

8. A maximum enrollment of 30 students in recitation or laboratory sections.

9. Buildings and equipment of the value of at least $100,000.

10. A productive endowment sufficient to yield a net annual income of at least $10,000 available for instructional purposes in the college department (liberal arts and sciences). If the institution offers courses in addition to the usual liberal arts course, it shall have a correspondingly larger income.

11. A library of not less than 10,000 bound volumes in addition to public documents.

12. Laboratory equipment of a value of not less than $3,000 in physics ($4,000 if work is offered in advance of one-year course), $2,500 in chemistry, and $2,500 in biology.

13. In addition to the foregoing specific requirements, the general standard of the administration and faculty shall be considered.

Admission to graduate courses may be granted only to those who have had the requisite undergraduate work in those courses or departments. But a student of mature age who satisfies the Dean and the department concerned of his ability to pursue graduate work in a given line may be enrolled in particular graduate courses, without reference to a degree, and permitted to carry on such study or investigation under the direction of a department of the University as the department shall recommend and the Dean approve.

Application blanks for admission may be secured from the Registrar of the University. Every applicant must submit with his application for admission an official transcript of his college record.

CHARACTER OF GRADUATE WORK

The principal aim of graduate study is the development of the power of independent work and the promotion of the spirit of research. Each candidate for a degree is expected to have a wide knowledge of his subject and of related fields of work; for the graduate student is not expected to get from lecture and laboratory courses all the knowledge and training necessary to meet the requirements for his degree.

Students, especially candidates for the doctor's degree, are warned against restricting themselves to the courses prescribed or suggested by the departments in which they are studying. Each student is expected to do a wide range of private reading and study, and in many cases will find it advisable to take one or more courses of lectures quite outside the field of his chosen subject.

REGISTRATION AND PROGRAM OF STUDY

The following regulations concerning registration and program of studies are laid out primarily for first-year students. Second-year and third-year graduate students fill out their programs irrespective of the unit value of courses, according to their needs, under the advice of their instructors.

Registration.—Each graduate student must register when he first connects himself with the University and afterwards at the beginning of each semester.

The registration of a new student may be accepted at any time provided the student is prepared to take up courses actually under way. Credit towards the fulfillment of the residence requirement dates, however, from the time of registration and not from the beginning of the semester or year in which the student enters. Registration will not be permitted later in the year than April 1, except in the

case of students who expect to continue through the summer session, or are returning to complete a year's work which has been broken into by illness or other unavoidable interruption.

The first registration, or that upon entrance, is permitted only after the student's application for admission to the Graduate School, setting forth his educational attainments, has been duly approved.

A new student must fill out in duplicate an application for admission and submit it to the Registrar, from whom, after the approval of his application, he will receive a card of admission and a study-list which will give details of procedure in registering. He should fill out the study-list after consultation with his adviser, or the person in charge of his major work, and also with the instructors whose courses he wishes to elect. *In all cases, registration must be completed within two weeks.* Otherwise it is subject to a fee of one dollar.

Changes in Study-Lists.—A graduate student is expected to plan his work so carefully that changes in his study-list during the semester will not be necessary. When a change seems advisable, however, it may be permitted without fee if made within three weeks of the date of registration. After that date a fee of one dollar is charged for each change, except that the total charge for rearrangement authorized on any one change slip shall not exceed two dollars.

Advanced Undergraduate Courses Open to Graduate Students. 1. *Courses not open to students below senior standing.* Unless otherwise specified on the student's program by the department concerned, such courses listed for four or five hours of undergraduate credit, are treated as unit courses for graduate credit; or as half unit courses when listed for less than four hours of undergraduate credit.

2. *Courses open to students of junior standing.* Unless otherwise specified on the student's program by the department concerned, such courses listed for four or five hours of undergraduate credit are treated as half-unit courses for graduate credit, or as quarter-unit courses when listed for two to three hours undergraduate credit. Courses to which sophomores are regularly admitted may not be taken for graduate credit, either major or minor.

Transfer of Undergraduate Credit.—No credit earned during the undergraduate course may be transferred for graduate credit, unless such credit was earned in time additional to the time normally required for the bachelor's degree, in the second semester of the senior year, and then only for minor subjects, and on petition. When undergraduate courses with variable semester hours are counted for graduate credit, the transfer is made on the basis of one unit for four semester hours.

Seniors and Graduate Study.—If at the end of the first semester of his senior year a student has so far completed his work for the bachelor's degree that his program for the second semester is not full, he may elect one or more graduate courses. But such election must be in accordance with Graduate School rules and must be approved by the Dean at the time of registration. *In no case may courses be counted for graduate credit on a program which requires more than twelve formal class, lecture or laboratory exercises a week, without petition.*

Miscellaneous and Listeners' Courses.—Graduate students are permitted under proper circumstances to attend classes as listeners, and to elect miscellaneous subjects, that is, courses which do not count toward an advanced degree. Listeners'

cards may be obtained at the Dean's office. Under the authority conferred by the faculty on the Dean no student with a full minimum program will be permitted by the Dean to visit more than one class or to take more than one miscellaneous subject, nor is any subject open as a listener's or miscellaneous course unless it has a specific educational bearing on the student's major or minor subjects of study.

A student who elects a miscellaneous course is required to register in it, do the work, and pass the semester examinations, unless he is permitted to withdraw under the rules. A student who has a listener's card is not permitted to participate in the classwork or the examination.

No student may register for a full minimum program of work for graduate credit if it is necessary for him to carry at the same time more than one miscellaneous subject and to visit one course.

Students on the Staff.—Assistants and others on the University staff who undertake to do graduate work are permitted to take an amount of work determined by the terms of their employment. Such a student, if required by his engagements to teach more than five classes a week or to have laboratory work or supervision exceeding ten hours a week, may not receive his master's degree at the end of one year, nor his doctor's degree at the end of three.

The enrollment of a member of the staff is subject to the approval of the officer to whom he is responsible as a member of the staff and of the Dean of the Graduate School with reference to the amount of work to be taken. Before credit may be recorded for such graduate student at the end of a semester, the head of the department in which he is employed, or some one authorized by the head, must certify that the time given to graduate work by the student has not impaired the work for which he is paid by the University.

Residence and Work Done Elsewhere.—Continuous residence and study are required of all members of the Graduate School, unless they are granted leave of absence by the Dean, upon recommendation of the professor in charge of their work, for the purpose of carrying on elsewhere studies or investigation in the line of work of their degrees.

Credit for work done elsewhere is not transferred. The candidate is examined here on all the work required for the degree.

Graduate Study in the Summer.—Graduate students in the summer session are subject to the same scholastic requirements as those in the regular University year. Their study lists must be approved by the Dean of the Graduate School, or his representative. Attendance on four summer sessions, or one semester and two summer sessions, is considered the equivalent of one year in residence. If in these sessions the required amount of work is properly done a master's degree may be earned in this way. The faculty is unwilling to accept summer-session work beyond the master's degree towards the doctor's degree, except in the case of a student who works in a summer session preceding or following a regular year's attendance at the University. In no case may the last year's work for the doctorate be done in disconnected summer sessions.

No course offered in the summer session may be taken for credit towards a higher degree unless it is specially described in the summer-session circular as accepted for that purpose.

Summer Work in Medical Sciences.—Graduate courses in medical sciences are offered in the summer quarter between June and September at the College of Medicine of the University of Illinois in Chicago. Circulars describing the courses offered and conditions of admission and work may be obtained from the Secretary of the College of Medicine, Congress and Honore Streets, Chicago.

Failures.—A graduate student who fails in any course in his major subject cannot secure his degree in the same year in which the failure occurred. No condition examinations are given graduate students.

Withdrawal.—If after registration a graduate student wishes to withdraw from any course or to add other work, he must first secure the necessary papers from the Dean's office. See the regulations concerning changes in study lists, page 10. If he wishes to withdraw from the University he must get clearance papers at the Dean's office.

DEGREES

Masters' Degrees

Character of Masters' Degrees.—The master's degree conferred depends upon the character of the bachelor's degree. The usual practise is that A.M. shall follow A.B., that M.S. shall follow B.S. However, this practise may be departed from in cases where the undergraduate course of study of the candidate was of a kind for which some reputable institutions in this country give A.B., while others give B.S. Such departure from the regular practise is permitted, however, only on individual petition duly approved.

Amount of Work Required.—Candidates for the degree of Master of Arts or Master of Science are required to do at least one full year's work in residence, including a thesis. By this is meant from four to five units course each semester, or their equivalent. A unit course is one which requires ten hours of time a week through one semester, or a minimum of 180 hours, irrespective of the mode of distribution of that time in class work, laboratory work and private study. Four such courses or their equivalent constitute a full *minimum* program for one semester, and eight such courses, or their equivalent, constitute the *minimum formal* year's work accepted for a master's degree. Only first rate students are permitted to secure a degree with this minimum program.

Unless otherwise permitted, on individual petition duly approved, every student must take each semester at least one course open to graduate students only (courses numbered 100 and upwards).

In the first year of his graduate study each student is required to attend a minimum of four formal class, lecture, or laboratory exercises a week. In no case is he permitted during his course to attend more than twelve a week, without permission.

Work Done Elsewhere.—Exception is made to the requirement that all work for the master's degree must be done in residence at the University in the case of members of the staff and high school teachers residing and employed in Urbana or Champaign who have spent half of their time in graduate study through a year

at some other approved institution. They may complete the requirements for the master's degree in a year of residence here, spending half their time in study. The candidates must take examinations in the work done elsewhere as well as in that done at this university.

Majors and Minors.—A candidate for a master's degree may do all his work in one subject, or he may select a major and one minor, or a major and two minors. A major or minor denotes the field of knowledge of a department, or such part thereof as constitutes a separate and independent division of that field. For a master's degree a major is at least half the work, or a minimum of four units, for one year. Less than one unit may not be counted as satisfying the requirements of a minor without the approval of the department concerned.

A program of studies for a first-year graduate student which is limited exclusively to the investigation of a single problem will not be approved.

Foreign Language.—The ability to use one or more of the modern languages ordinarily studied in the undergraduate curriculum is expected of all candidates for the master's degree, and in some lines of study is required. On this matter students should consult the heads of the departments in which their major subjects lie.

Master's Thesis.—Each candidate for a master's degree is required to present a thesis on some subject approved by the professor in charge of his major work and the Executive Faculty of the Graduate School. Such approval, except in case of students working for a master's degree in summer sessions only, must be secured not later than six weeks from the time when the student begins his year of residence. Students working for a master's degree exclusively in summer sessions must announce their thesis subjects not later than the beginning of their third session in residence. The requirement of a thesis may be waived, however, upon the recommendation of the head of the department in which the student is doing his major work and the approval of the Dean, provided application to waive the thesis is made at the time for announcing thesis subjects. A student excused from writing a thesis must replace it with additional courses of instruction.

No one will be excused from writing a thesis unless one-half of his program of studies consists of courses numbered 100 and upwards.

The thesis required from a candidate for a master's degree ordinarily will demand one-fourth of the student's time and may not exceed one-third of it. The thesis must be typewritten, on "thesis paper,"* and the title page must be printed. The thesis in its final form, together with a certificate of approval by the proper officer, must be left by the professor in charge at the Dean's office at least two weeks before the date on which the degree is to be conferred. No article prepared for another use, or previously published, will be accepted as a thesis.

Thesis Work on Leave of Absence.—Under proper conditions a student may be permitted to complete the last fourth of his work, if devoted to his thesis, under leave of absence. To get such permission the student must have secured credit for at least six units; must petition for the privilege; must submit to the Dean an

*No other will be accepted by the Dean. "Instructions for the preparation of theses" may be obtained at the Dean's office.

outline of the proposed investigation, approved by the head of his major department; and must submit satisfactory evidence that adequate facilities are available to him at the place where he intends to do the proposed work. Approval on all these points must be obtained one collegiate year before the thesis is due.

Grades.—Student's work is graded in five classes, A, B, C, D and E. The last indicates a failure. D indicates unsatisfactory, though passable, work. The degree will not be awarded to any student who does not secure a grade of B or higher in three-fourths of the work (number of units) for the degree, including his thesis.

A failure or absence from examination in any course may prevent the conferring of the degree; and, as already indicated, failure in any course in the major field precludes the conferring of the degree in the same year.

Marine Biological Laboratories.—Students in zoology, candidates for the master's degree, part of whose necessary preparation is experience in a marine or fresh-water biological laboratory or station, are permitted to offer, in part fulfillment of the requirements for the master's degree, work done in such fresh-water or marine laboratory; provided that the student who wishes to have such work accepted make application before beginning work in such laboratory; that the selection of the laboratory at which he is to work has been approved by the faculty beforehand; that the time to be spent in such work be not less than six nor more than nine weeks in any one summer; that the instructors under whom the student is to work have been previously accepted by this faculty; that he submit to an examination here on the work done at such laboratory; and that a certificate of attendance from a proper officer of the laboratory or station be submitted and a full written report of the work done in the shape of notes, or otherwise, be required; and that the student shall be in residence here at the University for one full academic year during which he shall do the rest of the work necessary for his degree.

The experience at a marine laboratory which, as indicated above, is optional with the candidate for the master's degree, is required of all candidates for the doctorate in zoology.

The marine biological laboratories which have thus far been approved as institutions at which students of this University may take work for record here are:

Marine Stations:

Marine Biological Laboratory, Woods Hole, Massachusetts
Harpswell Marine Laboratory, Casco Bay, Maine
Puget Sound Station, Friday Harbor, Washington
Hopkins Marine Laboratory of Stanford University, Pacific Grove, California
Scripps Institute for Biological Research, University of California, LaJolla, California
Carnegie Institution Laboratory, Dry Tortugas, Florida
Bermuda Biological Station, Bermuda
Brooklyn Institute Biological Laboratory, Cold Spring Harbor, L. I.

Fresh-Water Stations:

Douglas Lake Station, University of Michigan, Topinabee, Michigan
Ohio State University Laboratory, Cedar Point, Ohio
University of Wisconsin Lake Laboratory, Madison, Wisconsin

Similar arrangements are made, under similar conditions, for students of geology in connection with Geological Surveys.

MASTERS' DEGREES IN ENGINEERING

Two classes of second degrees are open to graduates of the College of Engineering, namely, academic and professional.

The academic second degree in engineering is Master of Science, following Bachelor of Science, in architecture, architectural engineering, civil engineering, electrical engineering, etc. This degree is conferred in accordance with the regulations described above for *academic work in residence only.*

The *professional* second degrees in engineering are as follows:

Master of Architecture, after B.S. in architecture.

Architectural Engineer, after B.S. in architectural engineering.

Civil Engineer, after B.S. in civil engineering or B.S. in municipal and sanitary engineering.

Electrical Engineer, after B.S. in electrical engineering.

Mechanical Engineer, after B.S. in mechanical engineering.

Engineer of Mines, Civil Engineer, Electrical Engineer, or Mechanical Engineer, after B.S. in mining or railway engineering, according to the course.

Professional degrees are conferred on two classes of candidates: (1) graduates of the College of Engineering of the University of Illinois who have been engaged in acceptable professional work away from the University for a period of not less than three years after receiving the degree of Bachelor of Science; (2) graduates of the University of Illinois, or of institutions of equal standing who have been engaged in acceptable professional work in residence at the University for a period of not less than three years after receiving the degree of Bachelor of Science.

In "acceptable professional work" may be included contributions to technical literature, activity in professional societies, investigation of engineering problems, and the teaching of engineering subjects.

A candidate must declare his candidacy and file with the Dean of the College of Engineering, as chairman of the committee in charge, a detailed statement covering his professional study and experience, not later than the first Monday in November preceding the commencement at which he proposes to qualify. Prior to December 31 next succeeding, he must submit for approval an outline of his proposed thesis and he must file his completed thesis not later than April 1. If the statement of professional experience and study and the thesis are accepted, the candidate must present himself at commencement in order to receive the degree.

Candidates for professional engineering degrees who already hold the degree of Master of Science may qualify for the professional degree after two years of professional work.

A candidate for a professional engineering degree must pay the incidental fee of thirty dollars on being notified that his professional study and experience are accepted as qualifying him to enter as a candidate for the degree. No one will be enrolled as a candidate for the degree at the following commencement who does not pay his fee at this time. When a candidate for a professional engineering degree has once been accepted and paid his fee, he is eligible to receive the degree at any time within five years, without additional fee, on completion of the requirements; provided, however, that unless he completes the requirements within two years his name will be dropped from the list of candidates and in order to receive the degree within the five-year period he must register once more.

THE DEGREE OF DOCTOR OF PHILOSOPHY

Majors and Minors.—The requirements for the degree of Doctor of Philosophy are a thoro mastery of a selected field of study, evidence of the power of independent investigation in this field, a broad knowledge of the wider field of study of which this major subject is a part, a general acquaintance with related fields of knowledge, and a mastery of all branches of study which are necessary to a full knowledge of the main subject. Each student who is seeking this degree is expected to choose for study and final examination a major subject, or field of study, and a first and second minor. The major subject is the field in which the student expects to become expert and an authority.

One minor must be a subject closely related to the major and may, under certain conditions and with proper approval, be a division of the major field of study. The remaining minor must be taken from a department of study other than that of the major.

For the doctor's degree no definite division of a student's time among major and minors can be made, to hold in all cases. In general the faculty approves an arrangement which, distributing the student's time through the required three years, divides it equally among his three subjects in his first year of graduate study; in the proportion of two to one, as between his major and first minor, in the second year of graduate study (his second minor being finished and dropped at the end of the first year); and gives all his time to his major during his third year.

To put the matter in another way, a course of graduate grade (from among the "hundred" courses) meeting twice or three times a week, corresponding roughly to what is sometimes called a full course, or in our terminology a unit course, running through the year, should ordinarily be sufficient for a second minor; a similar course running through two years should ordinarily be sufficient for a first minor.

While "full-time work" in the first year of graduate study, leading usually to a master's degree, is at least eight units for the two semesters, full-time work after the first year is not reckoned in units. The student is simply required to devote all his time to his work. Nor is there any necessary correspondence between the number of courses taken and the number of units required in the first year, or full-time work in any year. A first-year student might possibly secure all the credit necessary in two or three courses; and a second-year or third-year student might conceivably be devoting all his time to one course and his research or to his research alone.

Period of Study.—The *minimum* period of study required for securing the degree of Doctor of Philosophy is three years, during which the student is required to devote all his working time to his studies. All three years must be spent in residence at some accredited educational institution and either the first two or the last one of the three must be spent at the University of Illinois. The degree is conferred, however, not for residence during a certain period, but for scholarly attainments and power of investigation, as proved by thesis and examinations.

Credit for work done in other universities is not "transferred". The candidate is examined here on the subjects offered by him for the advanced degree. However, his period of residence at another institution of proper grade may be accepted in fulfillment of the residence requirement of the University of Illinois, so far as it goes.

EXAMINATIONS

Preliminary.—A. In major and minors.—Towards the end of his second year of study, or by special permission, at the beginning of his third year, the candidate for the degree must submit to a preliminary examination, in order to determine whether he will be accepted as a candidate for the degree in the following year. This examination is intended to test the student's knowledge of the fields of his major and minor subjects of study only. It is partly oral, and may be wholly so.

The student will not be admitted to his preliminary examination until the faculty is satisfied that he has finished substantially the equivalent of two years' graduate work. He must do a full year's graduate work between his preliminary examination and the completion of his work for the doctorate.

B. In Languages.—The candidate will be required to demonstrate his ability to read French and German and other languages needed in his work. This test of proficiency in the use of French and German must be passed before the student is admitted to the preliminary examination in major and minor subjects.

Final Examination.—At least two weeks before the time when the degree is conferred, the candidate must submit to a final examination, given by a committee appointed by the Dean. This examination is primarily on the research work of the student, as embodied in his thesis, but it is not confined to that. It extends to the whole field of the study of the candidate. It will not be confined to the courses which the candidate has attended in the University of Illinois only, if he has done part of the work elsewhere; nor even to the field covered by the courses specifically taken in this or other universities; but will be so conducted as to determine whether the candidate has a satisfactory grasp of his major subject as a whole, and a general acquaintance with the fields of knowledge represented by his course of study.

The final examination may not be divided. The examination must be taken all at one time even tho it requires several sessions.

If after having passed his preliminary examination, he fails in the third year of his study to meet the expectations of the professors in charge of his work, or in any way fails to maintain the standard of scholarship and power of research expected of him, he may be refused admission to the final examination.

Other Examinations.—Before the candidate is admitted to the final examination and the defense of his thesis, he may be required to take any other examination, oral or written, that is thought proper by the various departments in which he has studied.

The above examinations are in addition to those in the courses for which the student is registered. These must be taken at the times for which they are set in the examination schedule.

No candidate who does not secure a record of B or higher in at least three-fourths of his work will be recommended for the degree.

Thesis.—The power of independent research must be shown by the production of a thesis on some topic connected with the major subject of study. The candidate is expected to defend his thesis or dissertation before the members of the faculty, or as many of them as may wish to question him about it, in connection with his final examination.

The subject of the thesis should be chosen not later than the end of the second year of residence and must be submitted for formal approval by the faculty not later than six weeks from the beginning of his third year of residence.

Unless previously printed with proper authority, a typewritten copy of the complete thesis, *on thesis paper*,* must be deposited in the office of the Dean for presentation to the examining committee not later than two weeks prior to the final examination. All theses must be in the hands of the Dean at least four weeks before the time when the degree is to be conferred.

The doctor's thesis must be printed and one hundred copies deposited in the Library of the University by the candidate, not later than two weeks preceding the conferring of the degree. In form, the printed thesis must follow the "instructions for the preparation of masters' and doctors' theses", copies of which may be obtained at the Dean's office on application. If the student does not present a printed thesis he must deposit along with his manuscript the sum of seventy-five dollars ($75) or a bond for that amount satisfactory to the Comptroller of the University and the Dean of the Graduate School. A member of the faculty of the University of Illinois will not be accepted as a guarantor of such a bond. If a bond is accepted, it must be replaced at the end of one year with a cash deposit. At the end of two years, if the thesis has not then been printed by the student, the University will print it or such part of it as is deemed best.

The cash deposit made by the student who does not print his thesis by the end of the second year after his degree is conferred becomes the property of the University, to be used for the general purpose of printing theses.

The title-page of each thesis, whether typewritten or printed, must bear the words, "Submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in—[here put the major subject]—in the Graduate School of the University of Illinois." The title-page must also contain the full name of the author, his previous degrees, the full title of the thesis, the year of imprint and, if a reprint, the title and volume and a statement of the pagination of the volume from which it is reprinted. Each thesis must have an appendix giving a short biography of the candidate, including the institutions he has attended, his degrees and honors, the titles of his publications, and such other matters as are pertinent.

Doctor's Degree in Engineering.—The degree of Doctor of Philosophy in Engineering is offered in certain lines of academic work of a high scholastic type in engineering science for students who wish to prepare themselves as teachers, investigators, and experts.

The general requirements for this degree, as to preliminary education, linguistic attainments, etc., are the same as in other lines.

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*No other will be accepted by the Dean.

The following lines of engineering science are open as majors:

Engineering mechanics
Steam engineering
Hydraulic and sanitary engineering
Electrical engineering
Heating and ventilation engineering
Railway engineering
Masonry construction and structural engineering
Coal-mining engineering

The first minor may be any of the above or one of the following fundamental sciences or an authorized combination of two of them:

Theoretical mechanics
Mathematics
Thermodynamics
Chemistry
Geology
Physics (Experimental or mathematical)
Zoology
Botany

The second minor should be in other than engineering subjects.

SCHOLARSHIPS AND FELLOWSHIPS

A number of scholarships and fellowships have been established by the Trustees of the University. To first-year graduate students of ability and promise there are open a number of scholarships with a stipend of $300 each and freedom from tuition. incidental, and laboratory fees.* To second-year and third-year graduate students, that is, those who have had one or two years of graduate study, there are open fellowships with a stipend varying from $350 to $500, with freedom from the above-mentioned fees. The larger stipends are given only to students who are expected to take their degrees within the year. Each holder of a fellowship or scholarship must pay the matriculation fee of ten dollars, unless he holds a first degree from the University of Illinois, and also the diploma fee of ten dollars on receiving his diploma.

Candidates for these scholarships and fellowships must be graduates of the University of Illinois, or of colleges or universities having equivalent requirements for bachelors' degrees.

Application must be made on blanks to be obtained from the Dean of the Graduate School. These application forms should be sent to the Dean of the Graduate School as early as possible in February of the academic year preceding that for which the fellowship is desired. No application will be considered if received later than March first, until after April fifteenth, the date when appointees from the first list of applicants must accept or refuse their appointments.

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*Up to a certain amount

Persons appointed are notified on April first and must send the Secretary of the Board of Trustees notice of their acceptance or refusal by April fifteenth; and must agree that, if accepted, the appointment will not be resigned to take a similar one in any other institution during the year for which it is awarded.

Nominations to fellowships are made on the grounds of worthiness of character, scholastic attainments, and promise of success in the principal line of study or research to which the candidate proposes to devote himself. Scholarships and fellowships are not given to candidates who are over thirty years of age at the time when the appointment is to be made.

For second-year fellowships, adequate preparations in French, and for third-year fellowships, adequate preparation in French and German is required.

An appointment as honorary fellow, without stipend, may be made as specified for paid fellowships in the case of any one who has shown distinguished merit in his work.

LIBRARIES

The general University library, the library of the State Laboratory of Natural History, that of the State Geological Survey, and that of the College of Law are all at the University in Urbana. The libraries of the School of Pharmacy and the College of Medicine are in Chicago.

These libraries contain 461,598 volumes, and 54,615 pamphlets. Of these, 436,376 books and 51,056 pamphlets are in the libraries at Urbana; the rest are in Chicago. The library at Urbana also contains 2,128 maps and 5,192 pieces of sheet music. The departments at Urbana currently receive about 6,000 serials, while the College of Medicine and School of Pharmacy in Chicago receive 250.

The general library of the University is open daily, from 8 a. m. until 10 p. m. and on Sunday from 2 p. m. to 6 p. m.

The Mason Historical Library.—The library of western history collected by Edward G. Mason, Esq., long President of the Chicago Historical Society, is in the public library of the city of Champaign, and is accessible to University students.

The Dittenberger Classical Library.—The University possesses the library of Wilhelm Dittenberger, at one time Professor of Classical Philology in the University of Halle. This library contains 5,600 items. It includes the works of the poets and prose writers, numerous works on grammar and history of literature, and between four and five thousand dissertations and programs on special topics. There are also many works dealing with other departments of classical philology, as epigraphy, history of ancient peoples, archeology, philosophy, history of art, geography, chronology, metrics, etc.

The Heyne Library of Germanics.—The library of Professor Moritz Heyne of the University of Gottingen was bought by the University. It contains about 5,200 volumes. The collection is rich in the general field of German philology and in lexicography. It has many rare first editions of works of German literature from the sixteenth, seventeenth, and eighteenth centuries and has sets of a number of rare periodicals.

The Gröber Library in Romance Languages.—The University also possesses the library of Professor Gröber of the University of Strassburg. This library contains about 6,500 titles.

The Vahlen Library, of the late Johannes Vahlen, contains about 10,000 volumes and is in itself an excellent working library in classical philological literature. It is well supplied with texts of Greek and Latin authors.

The Aron Library, collected by the late teacher and student of pedagogy, R. Aron, contains about 20,000 volumes. It is a scholarly collection of educational documents, among them many original and early editions, and furnishes first-hand material for the study of educational movements in Europe, especially in Germany, from the time of Luther and Comenius to the present. The collection of German "Fibeln" or school readers is unique, and the material for the history of juvenile songs and literature, the set of 17th and 18th century atlases, and the collection of rare hymn books and juvenilia make the collection very useful to students of education.

FEES AND EXPENSES

Except as noted below, graduate students pay fees as follows:

Matriculation fee	$10.00
Incidental fee, each semester	25.00
Diploma fee	10.00
For late registration	1.00
For change in study-lists	1.00

All graduate students who have not matriculated as undergraduates at the University of Illinois pay the matriculation fee on entrance.

All graduate students pay the diploma fee.

No tuition or incidental fee is charged for graduate courses to scholars, fellows, or members of the corps of instruction or the staffs of the University libraries or of the scientific bureaus or experiment stations, who are appointed by the Board of Trustees, nor for undergraduate courses on their study-lists if approved by the heads of the departments and by the Dean of the School as necessary or desirable for the proper completion of the work for the degree. Otherwise graduate students who take undergraduate courses must pay the proper undergraduate fee.

Each student working in the laboratories, or in the drafting or engineering classes, is required to make a deposit of from 50 cents to $10.00, to pay for chemicals and apparatus used, and for any breakage or damages. But no charges or deposits for laboratory materials are required from scholars, fellows, or members of the corps of instruction or scientific staffs mentioned above, except when breakage or consumption of materials exceeds a certain allowance.

Table board may be obtained at prices ranging from $7 a week.

Room rent, single room, ranges from $15 a month; double room, $10 a month, each person.

THE GRADUATE CLUB

The Graduate Club is an unofficial organization of the graduate students and faculty. Its purpose is to furnish an opportunity for those working in different departments to become acquainted with one another and thus counteract the tendency toward narrowness which intense specialization may sometimes induce.

DEPARTMENTS OF INSTRUCTION

Courses open to graduate students are of two classes. The first class is wholly of graduate grade, and the courses are numbered 100 upwards. The second class includes the courses classified as for graduates and advanced undergraduates. These carry numbers below 100. The courses numbered 100 and upwards are all accepted for major credit. Those of the other group are in many cases accepted for minor credit only. This is especially true of courses which are open to juniors.

All courses have certain prerequisites for admission. Inasmuch as the prerequisite preparation may be gained at other institutions from courses differing from those offering a similar preparation at the University of Illinois, so that a statement of prerequisites as given here would not be understood elsewhere, their description is omitted altogether. However, a student who wishes to enter a particular course must satisfy the department concerned that he has had in some form the prerequisites for admission to the course.

For the convenience of first-year students the credit value of graduate courses is given in units. These values have no significance for second-year and third-year students.

The credit received for "courses for graduates and advanced undergraduates" is in accordance with the regulations of the Graduate School circular, page 10.

Students are admitted to graduate standing in agriculture who have had a thoro training in the sciences underlying agriculture, and who are otherwise eligible to the Graduate School, even tho their undergraduate course of study lacked to some extent the amount and kind of technical work in agriculture included in the course of study for the bachelor's degree in agriculture at the University of Illinois.

ACCOUNTANCY

A student may major in accountancy for the Master's degree only. The courses may be taken for minor credit by applicants for the Master's or Doctor's degree in other departments with the approval of the adviser. The courses in accountancy for graduates only may be selected by those who have had approximately 15 university accountancy credits including accountancy 3a or its equivalent. Accountancy 4a is a prerequisite for 104; 3b for 119; 13 for 113 and 20 for 120.

The courses for graduates and advanced undergraduates may be taken by those who have had the equivalent of 12 university accountancy credits.

Courses for Graduates

103. Advanced Theory and History.—The most prominent accounting theories analyzed and their historical development studied with reference to the requirements of economic principles and business activities. *Twice a week; both semesters. One unit.* Assistant Professor LITTLETON

104. Accounting System.—Analysis of operations of industrial and mercantile enterprises of various types and the designing of adequate accounting systems therefor. *Twice a week; both semesters. One unit.* Professor Scovill

110. Accounting Reports.—Methods of presenting reports of audits, investigations and operations. Interpretation of accounting data. *Twice a week; second semester. One unit.* Associate Professor Filbey

113. Governmental Accounting.—A study of the requirements of accounting for federal, state, municipal and institutional bodies. *Twice a week; second semester. One unit.* (Not given in 1921-22). Professor Morey

120. Income Tax Development.—A comparative study of the accounting features of the income tax acts of England, the United States, and of the several states. Accounting intricacies of the present federal act. *Twice a week; first semester. One unit.* (Not given in 1921-22). Associate Professor Filbey

129. Thesis.—*Once a week; both semesters. One unit.*
Members of the staff

Courses for Graduates and Advanced Undergraduates

3a-3b. Advanced Accounting and Auditing.—The second semester may not be taken without the first. *Three times a week; both semesters.*
Professor Scovill, Associate Professor Filbey,
Assistant Professor Littleton

4a. Cost Accounting.—(a) Cost accounting applied to factory procedure, overhead expenses, the installation and control of cost systems, presentation of cost data; (b) as a basis for manufacturing efficiency; (c) the construction of cost systems. *Twice a week; first semester.* Assistant Professor Littleton

4b. Accounting Systems.—Systems of various mercantile establishments and specialized businesses as banks, building and loan associations, insurance companies, brokers, and the several types of public utility corporations. *Twice a week; second semester.* Professor Scovill

5a-5b. C. P. A. Problems.—Representative problems of various types, including questions on theory of accounts and auditing. The second semester may not be taken without the first. *Twice a week; both semesters.* Professor Scovill

13a. Governmental Accounting.—*Twice a week; either semester.*
Professor Morey

20. Income Tax Procedure.—Application of the requirements of the Federal income excess-profits and war-profits taxes. *Twice a week; second semester.*
Assistant Professor Filbey

AGRONOMY

Students taking their major work in Agronomy must have had the major courses in Agronomy, or the equivalent, offered to undergraduates in the College of Agriculture of the University of Illinois. Graduate students may specialize either in Soils or in Crops. Courses 7, 11, and 12, or the equivalent, will be required of those specializing in Crops. Graduate credit is allowed graduate students registered

in Agronomy 10 except those specializing in Soil Physics, and in Agronomy 11 except those specializing in Soil Biology. Graduate credit is allowed in Agronomy 7 and 22 for students specializing in Soils. While everyone seeking a doctor's degree with Agronomy as a major will be required to have a general knowledge of the whole field of Agronomy, each student is expected to prepare a thesis in some one of the divisions, soil fertility, soil physics, soil biology, plant breeding, or crop production.

Students who are taking their major work in other departments and choose Agronomy as a minor, must have had previously the work in chemistry, botany, and other fundamental sciences prescribed for the undergraduate course in Agronomy in the College of Agriculture, or the equivalent.

Courses for Graduates

101. Soil Investigations.—Systems of soil investigation; sources of error and methods of control; interpretation of results. *Twice a week; both semesters. One unit.*
Assistant Professor DeTurk

104. Seminar in Agronomy.—*Once a week; both semesters. One-half unit.*
Professor Whiting and others

111. Soil Biology.—Critical study of the bio-chemical methods of soil investigations; interpretation of experimental results and application of statistical methods; outlining new methods of attack for research problems. *Once a week; first semester. One-half to one unit.* Professor Whiting

112. Advanced Plant Breeding.—Genetics of crop plants; genetic interpretation of inheritance of size, yield, disease resistance and of effects of selection; linkage and correlated characters, multiple allelomorphs. Lectures. *Twice a week; second semester. One-half unit.* Assistant Professor Woodworth

114. Crop Production.—Crop ecology; methods and results of crop production investigations. *Once a week; both semesters. One-half to two units.*
Professor Burlison

118. Investigation.—A special problem is chosen by each student. Graduate students taking a thesis should so indicate in registering in Agronomy 118. Consultation one to five times a week for different students. *Both semesters. One to four units.* Professors Burlison, Whiting, and Assistant Professors DeTurk, R. S. Smith and Woodworth

Courses for Graduates and Advanced Undergraduates

7. Advanced Farm Crops.—Climatic and soil factors; rotation; distribution of labor; cost of production; pure seed production; supply and consumption of products and by-products; storage and marketing. *Three times a week; second semester.* Professor Burlison

10. Soil Physics.—The problems, methods and literature of soil physics are treated in lectures; laboratory work, if taken, is arranged to meet the needs of each student. *Lectures twice a week; laboratory one to three times a week; second semester.* Assistant Professor R. S. Smith

11. Soil Biology.—Bio-chemical activities of soil microorganisms in relation to soil fertility. *Five times a week; second semester.* Professor Whiting

12a. Soil Fertility, Fertilizers, Rotations.—The influence of fertility; effect of different crops on the soil and on succeeding crops. *Twice a week; second semester.*
Assistant Professor DeTurk

22. Plant Breeding.—Improvement of field crops, selection. *Twice a week; first semester.* Assistant Professor Woodworth

ANIMAL HUSBANDRY

Students entering graduate work in animal husbandry must have had a thoro training in the fundamental principles of the subject either in connection with or in addition to a course of study in agriculture substantially equivalent to that offered in this University.

Courses for Graduates

103. Live Stock Experimentation.—Objects, methods, and the sources of error in experimental work dealing with the feeding, breeding, and management of farm animals. *Once a week; second semester. One-half unit.* Dean Davenport

110. Animal Nutrition.—Biochemistry, digestion, metabolism, and nutritive value of proteins. *Twice a week; both semesters. One unit.* (Not given, 1920-21.)
Professor Grindley, Associate Professor Mitchell

111. Animal Nutrition.—Biochemistry, digestion, metabolism and nutritive value of fats and liquids, carbohydrates, and inorganic substances. *Twice a week; both semesters. One unit.* Professor Grindley, Associate Professor Mitchell

112. Research.—Investigations along the following lines:

(a) Economic factors involved in meat production.
Professor Mumford, Professor Rusk

(b) Systems of live stock farming. Professor Handschin

(c) The valuation of pedigrees. (Not given, 1920-21).

(d) Animal nutrition. The chemistry of feeding stuffs; metabolism experiments and biochemical studies connected with the nutrition of farm animals.
Professor Grindley, Associate Professor Mitchell

(e) Genetics. Problems in heredity and variation. Professor Detlefsen

(a), (b), (c), and (f), one to three times, (d) and (e), five times a week; both semesters. One to two units. These courses may be taken during the summer by special permission.

116. Seminar in Animal Husbandry.—*Once in two weeks; both semesters.*
Members of the department

117. Genetics.—Genetic experiments; biological and mathematical methods employed; the validity of the conclusions. *Two to five times a week; both semesters. One to two units.* Professor Detlefsen

Courses for Graduates and Advanced Undergraduates

7. Principles of Animal Nutrition.—*Five times a week; first semester.*
Associate Professor Mitchell

22. Advanced Stock Judging.—Animal conformation with reference to market and show yard form; quality and condition. *Five times a week; first semester.*
Various members of the department

24. Meat.—Influence of type, condition, age, sex, and feeds on the yield and market grade of meat products. *Once a week; second semester.* (Not given, 1920-21.)
Professor ————

26. Swine.—The economical production of pork. Problems and methods. *Once a week; second semester.* Mr. Rice

27. Sheep Husbandry.—The industry in leading sheep growing countries and particularly in different parts of the United States. *Once a week; second semester.* (Not given, 1920-21.) Professor ————

28. Advanced History of Breeds of Live Stock.—Methods of prominent breeders, and performances of great individual animals: beef, horses, sheep, and swine. *Once a week; first semester.*
Professor ———— and other members of the department

ARCHITECTURE AND ARCHITECTURAL ENGINEERING

The prerequisite for graduate work in architecture and architectural engineering is the equivalent of the undergraduate courses required at the University of Illinois for the degree of Bachelor of Science in architecture and architectural engineering in the branches of the subjects in which registration is desired.

Courses for Graduates

101. Architectural Construction.—Design of special structures. *Twice a week; both semesters. One-half to one unit.*
Professor Ricker and Professor Provine

103. Advanced Architectural Graphics.—*Twice a week; both semesters. One to two units.* Professor Provine

104. Architectural Design.—Advanced course. *Twice a week; both semesters. One to four units.* Associate Professor Davison

105. Architectural Practise.—Contracts, specifications, and office methods. *Twice a week; first semester. One-quarter to one-half unit.*
Professor Provine

ASTRONOMY

The prerequisites for graduate study in astronomy are mathematics through the calculus, a year's course in observational astronomy, and a course in college physics.

Courses for Graduates

101. Seminar.—*Three times a week; both semesters. One unit.*
Professor Stebbins

102. Stellar Astronomy.—Orbits of binary stars; variable stars; theoretical photometry. *Three times a week; both semesters. One unit.* Professor Stebbins

Courses for Graduates and Advanced Undergraduates

7-8. Theoretical Astronomy.—Celestial mechanics; theory of orbits. *Three times a week; both semesters. One unit.* Professor Stebbins

14. Observational Astronomy.—The working methods of an astronomical observatory. *Three times a week; second semester. One unit.* Professor STEBBINS

15. Geodetic Astronomy.—The sextant, transit, and zenith telescope; methods similar to those of the United States Coast Survey. *Three times a week; first semester. One unit.* Professor STEBBINS

BACTERIOLOGY

Students electing bacteriology as a major study must have had at least 10 semester hours of bacteriology and 15 semester hours of some other physical or biological science. Before receiving a degree a student must have had work equivalent to courses 5a, 5b, or 20, 8, 26, 103 and 107; candidates for the doctor's degree will be held responsible for a general knowledge of the subject as applied to plant pathology, dairy husbandry and soil biology. Courses in these subjects are listed under their respective departments and will be counted, after conference with adviser, toward the requirements for the doctor's degree.

Candidates for the doctor's degree with a major study in some other field than bacteriology, who elect a first or second minor in bacteriology, must offer a minimum of three units for the first minor and two and one-half units for the second minor selected from the courses offered in this department or certain courses in the departments mentioned above.

Courses for Graduates

103. Physiology of Bacteria.—Lectures and discussions on fermentation growth and death; metabolism; variability of species; characters; mutations; life cycles; standard and biometrical classifications; history of classifications. *Twice a week; first semester. One unit.* Associate Professor TANNER

107. Research.—For those students who are taking a major in bacteriology either for the doctor's degree or master's degree. *Both semesters. One-half to four units.* Associate Professor TANNER

The attention of students is called also to courses in bacteriology, offered in other departments. Certain of these courses will be accepted toward requirements for advanced degrees after conference with adviser.

Courses for Graduates and Advanced Undergraduates

7. Thesis and Special Problems.—Literature investigation and research on some project in bacteriology. *Time to be arranged. Both semesters. One-half to one unit.* Associate Professor TANNER

10. Epidemiology.—Lectures, assigned readings, special problems, and reports on the spread and control of epidemic diseases; methods of investigating epidemics; sanitary surveys, etc. *Twice a week; first semester. One-half unit.* Associate Professor TANNER

Bacteriology

8. Applied Bacteriology.—Water, sewage, and food bacteria. *Five times a week; second semester.* Associate Professor TANNER

18a-18b. Journal Meeting.—Required of all students majoring in general and pathological bacteriology. *Once a week; both semesters.*
Associate Professor TANNER

20. General Bacteriology.—For seniors and graduate students who do not take bacteriology as a major. Assigned readings in foreign literature. *Five times a week; first semester.* Associate Professor TANNER

26. Pathological Bacteriology.—Cultural and morphological characteristics of disease-producing organisms; immunity and serum reactions; routine diagnostic procedure. *Three times a week; first semester.* Associate Professor TANNER

BOTANY

Candidates for advanced degrees in botany must offer for admission at least 20 hours in university botany, or 15 hours in botany and 5 hours in zoology or in entomology.

Graduate students who desire to elect botany for minor credit must offer the equivalent of 10 hours in university botany as well as any other stated prerequisites to the courses selected.

Courses for Graduates

101. Individual Plant Development.—Origin of the individual; external and internal factors in its development and physiologic performance; response of the cell, somatic and generative, to external factors. *Once a week; both semesters. One-half to two units.* Professor HOTTES

102. Physiology.—Effects of external stimuli on growth and movement. *Once a week; both semesters. One-half to two units.* Professor HOTTES

104. Mycology.—Field and laboratory investigation of selected groups of fungi. *Once a week; both semesters. One-half to two units.* Professor STEVENS

106. Plant Pathology.—Diseases of plants, and disease agents. *Once a week; both semesters. One-half to two units.* Professor STEVENS

107. History of Botany.—A conference course with reading and lectures. *Once a week; first semester. One-half unit.* Professor TRELEASE

108. Taxonomy.—Monographic studies of critical groups. *Once a week; both semesters. One-half to two units.* Professor TRELEASE

109. Ecology.—The interrelation of plants and their environment. *Once a week; both semesters. One-half to two units.* Assistant Professor MCDOUGALL

110. Current Botanical Literature.—*Once a week; both semesters. One-quarter unit.* The Staff

Courses for Graduates and Advanced Undergraduates

7b. Methods in the Study of Fungi.—Isolation, cultivation, and inoculation of fungi and bacteria. *Once a week; second semester.* Professor STEVENS

9a-9b. Plant Anatomy or Physiology.—Problems to meet the needs of individual students. *Once a week; both semesters.* Professor HOTTES

14. Heredity, Variation, Evolution.—Cells and members of plants; adaptations and changes; mechanism of heredity; evolution. *Twice a week; second semester.* (Offered for 1922-23, and in alternate years.) Professor HOTTES

16b. Taxonomy and Morphology of Algae and Bryophytes.—Advanced practise on selected groups. *Once a week; second semester.* Dr. HAGUE

17a-17b. Taxonomy of Cormophytes.—Advanced practise on selected taxonomic or economic groups. Specialized studies, as of genera or families of Illinois plants. *Once a week; both semesters.* Professor TRELEASE

22a. Morbid Histology.—Histology of plant tissues; parasites in condition of disease. *Once a week; first semester.* Professor STEVENS

22b. Studies of Special Groups of Fungi or Diseases of Special Crops or Groups of Crops.—*Once a week; second semester.* Professor STEVENS

25a-25b. Plant Ecology.—The ecology of plants or of plant communities. *Once a week; both semesters.* Assistant Professor MCDOUGALL

26. Taxonomy and Ecology of Higher Fungi.—Advanced practise on selected groups. *Once a week; second semester.* (Offered for 1921-22, and in alternate years.) Assistant Professor MCDOUGALL

28a-28b. Taxonomy of Economic Fungi.—Advanced practise on selected groups of parasitic fungi. *Once a week; both semesters.* Professor STEVENS

29a. Comparative Morphology of Pteridophytes, Bryophytes and Angiosperms.—Character and scope of work on problems of special interest, with repetition of some phases of this work. *Once a week; first semester.* Dr. HAGUE

BUSINESS ORGANIZATION AND OPERATION

Work may be done in the field of business organization and operation for a major or a minor for the M.S. degree, and for a minor for the doctorate. To do major work in this field, the student must have completed an undergraduate curriculum equivalent to that of the college of commerce and business administration. To do minor work, he must have had at least five semester hours' credit in the principles of economics and courses in Business Organization and Operation 1 and 2 or the equivalent: Business Organization and Operation 4 is a prerequisite for 102.

Courses for Graduates

101. Marketing Policies and Problems.—Federal, state, and local regulation of mercantile business; unfair competition; trade agreements; trade marks; inspection of mercantile establishments; pure food acts; control over weights and measures, packing, storage, and shipment. *Twice a week; both semesters. One unit.* Associate Professor RUSSELL

102. Scientific Management.—The history of the scientific management movement; critical study of the proposed systems. *Twice a week; both semesters. One unit.* (Not given, 1921-22.)

129. Theses.—Time to be arranged. *Both semesters. One unit.* Associate Professor RUSSELL

Courses for Graduates and Advanced Undergraduates

4. Industrial Organization and Management.—Problems of organization and of administrative policy; supervision and management of industries and industrial units, etc. *Three times a week; first semester.*

CERAMIC ENGINEERING

Graduate work leading to degrees in either ceramic chemistry or ceramic engineering is offered by the department. Graduate students who wish to elect ceramic chemistry as their major field of study must have had the equivalent of twenty-five semester hours in chemistry and this must include satisfactory courses in general chemistry, qualitative and quantitative analysis, and either physical or organic chemistry. Such students must also have had at least one year of college physics and a training in mathematics which includes the calculus.

Candidates for the degree of Doctor of Philosophy in ceramic chemistry must fulfill the same general requirements in chemistry as candidates in other branches of chemistry. They must also offer physical chemistry as one of their minor subjects.

Courses for Graduates

101. The Chemistry of the Compounds of Silicon.—*Twice a week; both semesters. Three-fourths unit.* Professor WASHBURN

103. Silicon Chemistry.—Laboratory to supplement course 101, which must precede or accompany it. *One to two units. Second semester.*
Professor WASHBURN

102. General Technology of the Clay Industries.—Physical properties of ceramic materials and products; dependence on chemical composition, mineralogical constitution, and physical condition. *One to two units. Both semesters.*
Professor PARMELEE

104.—Technology of Glass.—Glassy silicates; limiting composition; physical and chemical properties of glasses and the dependence of these properties on composition. Lectures and laboratory. *One to two units.* Professor PARMELEE

Courses for Graduates and Advanced Undergraduates

4c. Drying and Burning.—Chemical and physical processes; types of equipment. *Daily; first semester.* Associate Professor HURSH

5. Ceramic Bodies.—Composition and properties of ceramic body mixtures; effects of various ingredients; development of special bodies. *Daily; second semester.*
Professor PARMELEE

6. Glazes.—Classes of glazes and enamels; composition, limits, properties and defects. *Daily; first semester.* Professor PARMELEE

8. Glass.—Raw materials, preparation, compounding, melting and shaping; chemical principles in the manufacture and decoration of vitreous silicates. *Twice a week; second semester.* Professors WASHBURN and PARMELEE

9. Ceramic Construction.—Plans, specifications, and estimates for ceramic equipments and industrial plants. *Four times a week; second semester.*
Associate Professor HURSH

10. Cements.—Cements, limes, plasters; composition; reactions; manufacture and testing. *Three times a week; first semester.* MR. LIBMAN

13. Cement Laboratory.—Silicate cements. *Three times a week; second semester.*
MR. LIBMAN

14. Cement Laboratory.—Lime and gypsum products; magnesia and other special cementing materials. *Three times a week; second semester.*
Associate Professor HURSH

15. Glass Laboratory.—Soda-lime, potash-lime, lead, barium, and zinc silicates; boro-silicates; fused and solidified glasses; problems. *Three times a week; second semester.* Professor WASHBURN

16. Enamels.—Various types of enamels, their composition, application, properties and testing. Lectures, laboratory. *Three times a week; second semester.*
Professor PARMELEE

17. The Principles of Physical Chemistry with Special Reference to Their Applications to Ceramic Materials and Process.—*Three times a week; first semester.*
Professor WASHBURN

19. Special Bodies and Glazes.—An intensive study of bodies and glazes, their physical properties as dependent upon their composition and the testing of the same. Lectures; laboratory. *Three times a week; second semester.*
Professor PARMELEE

20. Refractory Materials.—Properties and uses of refractory materials employed in the industries; relation between refractory power, chemical composition and physical condition; changes undergone by refractory materials at high temperatures. The subject will be presented as far as possible from the standpoint of the Phase Rule. Lectures and discussions. Assigned reading. *Twice a week; second semester.* Professor WASHBURN

CHEMISTRY

Graduate students who elect chemistry as their major subject of study must have had the equivalent of 25 semester hours in chemistry, including satisfactory courses in general chemistry, qualitative and quantitative analysis, and either physical chemistry or organic chemistry. They must also have had one year of college physics, mathematics through analytical geometry and, if they do not present an acceptable course in physical chemistry, the calculus. The ability to use the calculus is a prerequisite to all courses in physical chemistry.

Before receiving a degree in chemistry the student must have completed work equivalent to courses 31, 33 (or 102 and 102a), 14a, 14b, 9a, 9b. He is advised to take at least brief courses in the history of chemistry, gas analysis, metallurgy, water analysis, assaying, and chemical technology.

For students taking chemistry as a major, courses 14a, b, c, and d, 31, and 33 will be accepted only if on entering the Graduate School they have had the equivalent of 25 semester hours in chemistry.

Graduate students whose major subject is in some other department than chemistry, must have had the equivalent of 15 semester hours in chemistry. The ground covered must include satisfactory work in general chemistry and in qualitative and quantitative analysis. Such students are advised to make selections from the following courses: Chemistry 31, 33, 34, 14a, 14b, 9a, 9b, 15, and 25. Students will not be admitted to courses of a special nature, for graduate credit, unless they have previously taken the appropriate prerequisite courses from the above list.

Courses for Graduates

101. Theories of Chemistry.—Seminar. *Once a week; second semester. One-fourth unit.* Professor Noyes

102. Advanced Physical Chemistry.—The more important developments in physical chemistry. The kinetic theory, kinetic molecular methods, probability, Brownian movement. Atomic and molecular structure, the electron, radio-active disintegration, the quantum theory and its applications. Radiation. Thermodynamics, the first two laws. Theories of solution, thermodynamic potentials and fugacity. Free energy. The Nernst heat theorem. Lectures; problems. McLewis. A System of Physical Chemistry. *Twice a week; both semesters. Three fourths unit.* Associate Professor Rodebush

103. Advanced Inorganic Chemistry.—Descriptive inorganic chemistry; the rarer elements; periodic system. *Two to five times a week; both semesters. One-half to one and one-fourth units.* Associate Professor Hopkins

103a. Advanced Analytical Chemistry.—*One to five times a week; second semester. One-half to one and one-fourth units.* Assistant Professor Braley

103b. Special Topics in Analytical Chemistry.—Reports on the current literature of analytical chemistry, inorganic and organic. Required of all students taking a major or minor in analytical chemistry. Seminar. *Once a week; both semesters. One-quarter unit.* Associate Professor Beal

103c. Special Topics in Inorganic Chemistry.—Seminar. Rare earths. *Once a week; both semesters. One-fourth unit.* Associate Professor Hopkins

104. Advanced Organic Chemistry.—Geometric isomerism; optical isomerism; tautomerism; mechanisms of important reactions. *Twice a week; first semester. Three-fourths unit.* Professor Adams

104a. Advanced Organic Chemistry.—Special topics selected from the following: Carbohydrates; proteins; ureides; alkaloids; terpenes; relationships between chemical constitution and physiological properties; color and constitution; trivalent carbon; bivalent carbon; application of physical methods to organic problems, etc. *Twice a week; second semester. Three-fourths unit.* Dr. Marvel

104b. Advanced Quantitative Organic Analysis.—The proteins, alkaloids, glucosides, volatile oils, and other constituents of animal and vegetable tissues. *Twice a week; both semesters. One-half unit.* Associate Professor Beal

104c. Organic Chemistry.—Current literature. Required of all students majoring in organic chemistry. *Once a week; both semesters. One-fourth unit.* Professor Adams, Dr. Marvel

104d. Advanced Organic Chemistry.—Systematic study of the general reactions in organic chemistry. *Twice a week; second semester. Three-fourths unit.* Professor ADAMS

104e. Advanced Organic Chemistry.—Chiefly laboratory work. The study and development of methods which are suitable for large scale production. (Not given, 1921-22.) *Both semesters. One unit.* Professor ADAMS, Dr. MARVEL

105. Advanced Physiological Chemistry.—Structure and distribution of proteins; intermediary metabolism and the glands of internal secretion. *Twice a week; second semester. Three-fourths unit.* Associate Professor LEWIS

105a. Advanced Physiological Chemistry.—Difficult biochemical preparations; the use of the newer analytical methods. *One to five times a week; second semester. One-half to one unit.* Associate Professor LEWIS

105b-105c. Advanced Physiological Chemistry.—Recent development. *Twice a week; both semesters. One-half unit.* Associate Professor LEWIS

106. Animal Chemistry (Animal Nutrition).—*Five times a week; both semesters. One to one and one-half units.* Professor GRINDLEY

107a. Fuel Technology.—Fuel types: solid, liquid, and gaseous; sources, output, prospective supply, and industrial interrelations; conservation and combustion problems. *Once a week; first semester. One-fourth unit.* Assistant Professor LAYNG

109. Advanced Industrial Chemistry.—Chemical industries; development and chemical control of processes. *Twice a week; both semesters. Three-fourths unit.* Professor PARR

110. Water Supplies.—Sources of contamination of water supplies; purification for potable or technical use. *One to five times a week; both semesters. One-half to one unit.* Associate Professor BUSWELL

111. Research.—*Both semesters.*

Physical and Electrochemistry.

Associate Professor RODEBUSH

Inorganic Chemistry.

Associate Professor HOPKINS, Assistant Professor REEDY, Dr. KREMERS

Analytical Chemistry.

Associate Professor BEAL, Assistant Professor BRALEY

Food Chemistry.

Associate Professor BEAL

Organic Chemistry.

Professors NOYES, ADAMS, Dr. MARVEL

Water Chemistry.

Associate Professor Buswell

Physiological Chemistry.

Associate Professor LEWIS

Animal Chemistry (Nutrition).

Professor GRINDLEY

Industrial Chemistry.

Professor PARR, Assistant Professor LAYNG

Ceramic Chemistry.

Professor WASHBURN

Courses for Graduates and Advanced Undergraduates

***6. Chemical Technology.**—Technological chemistry as illustrated in those industries having a chemical basis for their principal operation and processes. *Three times a week; second semester.* Assistant Professor PUTNAM

***7. Metallurgy.**—General metallurgy; metallurgy of iron and steel. Fulton's *Principles of Metallurgy;* Stoughton's *Iron and Steel. Three times a week; first semester.* Assistant Professor PUTNAM

10a. Study of Water Supplies.—History, sources, contamination, and standards of purity of potable waters and waters for industrial purposes; analytical methods. *Three times a week; second semester.* Associate Professor BUSWELL

12. Chemistry of Colloids.—Laboratory exercises employing special apparatus and technique involved in the investigation of colloid systems. Discussion of systems of classification and the various theories proposed for the explanation of reactions of colloid systems. Practical application. *Two to three times a week; first semester.* Associate Professor BUSWELL

14a-14b. Organic Chemistry.—Noye's *Organic Chemistry.* (This course should be accompanied by Chemistry 14c and 14d.) *Four times a week; first semester; twice a week, second semester.* Professor NOYES

14c. Organic Chemistry Laboratory.—Organic synthesis. *Twice a week; first or second semester.* Drs. MARVEL and SOUTHER

14d. Organic Chemistry Laboratory.—Organic synthesis; quantitative and qualitative analysis. (Continuation of 14c, to accompany 14b.) *Twice a week; first or second semester.* Dr. SOUTHER

15. Physiological Chemistry.—*Five times a week; first semester.* Associate Professor LEWIS

15a. Problems of Metabolism.—Intended especially for medical students. *Three times a week; second semester.* Associate Professor LEWIS

21. Qualitative Organic Analysis.—Identification of pure organic compounds and mixtures. *Twice a week; first semester.* Dr. MARVEL

25. Food Analysis.—Quantitative organic analysis, with special reference to the examination of food products: alcohols, carbohydrates, fats and oils, cereals, nitrogenous bodies, preservatives, and colors. *Five times a week; first semester.* Associate Professor BEAL, Dr. ENGLIS

26. Pharmaceutical Chemistry.—The analytical chemistry of medicinal substances, with a discussion of the common types of pharmaceutical preparations. *United States Pharmacopoeia, Ninth Decennial Revision. Three times a week; second semester.* Associate Professor BEAL

27. Qualitative Analysis of the Rare Elements.—*Three times a week; first semester.* Associate Professor HOPKINS

28. Advanced Qualitative Analysis.—Designed especially for those intending to teach qualitative chemistry. *Twice a week; second semester.* Assistant Professor REEDY

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*Certain required inspection trips will be arranged in connection with courses 6 and 7. Student registering in these courses should take into consideration the expense involved, which will approximate $15.00 for each course.

31. Elementary Physical Chemistry.—The more important principles of physical chemistry. The purpose of this course is to give the experimental basis for a proper appreciation of physical chemistry. Lectures, problems. Walker: *Introduction to Physical Chemistry. Three times a week; first or second semester.*

Assistant Professor DIETRICHSON

33. Elementary Physical Chemistry.—A laboratory course to accompany Chemistry 31. Findlay: *Practical Physical Chemistry. Twice a week; first or second semester.*

Assistant Professor DIETRICHSON

34. Physical and Electrochemistry.—The theoretical principles of physical and electrochemistry and their applications. Including the mass law, the phase rule, thermochemistry, surface tension, colloids, catalysis, electrolytic and electrothermal processes, photochemistry. Lectures; problems. Washburn: *Principles of Physical Chemistry.* Rideal and Taylor: *Catalysis in Theory and Practise. Twice a week; both semesters.*

Associate Professor RODEBUSH

35. Electrochemistry.—Electrochemical reactions. Technical applications, including electric furnace processes. *Three times a week; first semester.*

Assistant Professor DIETRICHSON

46. Chemistry of Plant Products.—The occurrence of organic compounds in plants and their relation to plant nutrition. Lectures and laboratory. *Twice a week; second semester.*

Dr. ENGLIS

47. Physical Methods in Inorganic Problems.—Selected topics involving the application of the methods of physical chemistry. Lectures; assigned readings. *Twice a week; first semester.*

Assistant Professor REEDY

61. Industrial Chemistry Laboratory.—The preparation and purification of chemical products from raw materials on a scale sufficient to afford data for determining the economy of the processes employed. (This course should be accompanied by either 6 or 109.) *Three times a week; second semester.*

Assistant Professor PUTNAM

65. Fuels and Flue Gases.—Fuel inspection; gas analysis; determination of calorific values; calculation of efficiencies. *Three times a week; first semester.*

Assistant Professor LAYNG

66. Gas Engineering.—Gas machinery; ovens and appliances for carbonization; recovery of by-products. *Once a week; second semester.*

Professor PARR

69. Metallurgical Laboratory and Assaying.—The principles of metallurgy as illustrated in the fire assay of gold, silver, lead, and copper ores, mattes, and bullion. Pyrometric measurements, etc. *Twice a week; first semester.*

Assistant Professor PUTNAM

72. Paints, Oils, Turpentines, Varnishes, and Protective Coverings for Wood and Metals.—*Twice a week; first semester.*

Professor PARR and Assistant Professor LAYNG

76. Chemistry of Oils.—Fractionation; analysis; evaluation for fuel; gas manufacture; lubrication. *Twice a week; second semester.* (Given in 1918 and in alternate years.)

Assistant Professor LAYNG

77. Classification and Theories of Carbonization.—Classification; changes in composition; formation of mine gases. *Twice a week; second semester.*

Professor PARR

78. Metallography.—Constitution and microstructure of metals and alloys; properties, chemical and mechanical treatment, and structure. *Twice a week; second semester.* Assistant Professor PUTNAM

92a-92b. Chemical Literature and Reference Work.—Periods,leaders, journals. Required of juniors in chemistry and chemical engineering; required also of juniors who are majoring in chemistry. *Once a week; both semesters.* Miss SPARKS

95. History of Chemistry.—*Twice a week; first semester.*

Besides the formal courses outlined above, regular scientific meetings are held by the colloquiums of industrial, physical, inorganic, physiological, and organic chemistry; by the Chemical Club; by Phi Lambda Upsilon; and by the University of Illinois Section of the American Chemical Society.

Professor NOYES

CIVIL ENGINEERING

The prerequisite for graduate work in civil engineering is the equivalent of the undergraduate course required for the degree of Bachelor of Science in civil engineering in the branches of the subject in which registration is desired.

Courses for Graduates*

101. Irrigation and Drainage.—Survey, examination, construction, maintenance, and operation of works for irrigation and drainage of agricultural lands; the rights to the use of water. *Twice a week; both semesters. Half unit.* (Not given 1921-1922.)

103. Highway Construction.—Machinery and methods of handling materials. Contractor's organization and official control. *Twice a week; both semesters. One unit.*

Professor BAKER

106. Reinforced Concrete Design.—Elastic theory. *Twice a week; both semesters. One to two units.* Professor ————

107. Bridge Engineering.—Deflections; the statically indeterminate frame; swing bridges and arches; special graphical methods; suspension bridges; secondary stresses; impact. *Twice a week; both semesters. One to two units.*

Professor ————

124. Steel Building Construction.—Steel framing of fireproof office, industrial, and hotel buildings; wind bracing; long columns; eccentrically loaded columns; eccentric connection; analysis of special details. *Twice a week; both semesters. One to two units.* Associate Professor WILSON

THE CLASSICS

The Degree of Master of Arts in the Classics.—The major may be either Latin or Greek.

The Degree of Doctor of Philosophy in the Classics.—The degree is given in classical philology. Major work may be taken in either Latin or Greek, but whichever language is taken as a major, the other must be taken as the first minor.

*Courses offered to Junior and Senior students are open for minor credit to students majoring in other fields.

Greek

Preparation for first-year graduate work in Greek must include at least two years of preparatory Greek, two years of college Greek, and two years of college Latin. A reading knowledge of French or German, preferably the latter, is highly desirable for candidates in this subject. The study of history and philosophy is especially recommended.

Courses for Graduates

105. Plato and Aristotle.—*Both semesters. One unit.*

Professor OLDFATHER

106. Greek Drama.—Lectures; reading and discussion of selected plays from the great dramatists. *Twice a week; both semesters. One unit.*

Professor PEASE

110. Bibliography and Criticism.—Thesis course; the same as Latin 110. *Once a week; both semesters. One unit.* Professor OLDFATHER, PEASE, and others

Courses for Graduates and Advanced Undergraduates

5. Herodotus.—Selections. *Three times a week; first semester.*

Professor PEASE

6. Thucydides.—Selections. *Three times a week; second semester.*

Mr. ————

Latin

Preparation for first-year graduate work in Latin must include at least two years of preparatory Latin, and four years of college Latin, or three years of preparatory Latin and three years of college Latin. A reading knowledge of French or German, preferably the latter, is highly desirable. Some acquaintance with Greek is indispensable, and the study of history and philosophy is especially recommended.

Courses for Graduates

101. Latin Epigram.—*Twice a week; first semester. One unit.*

Professor CANTER

103. Cicero.—Selections from his philosophical works. *Twice a week; second semester. One unit.* Professor PEASE

104. Latin Paleography.—*Twice a week; first semester. One unit.*

Professor PEASE

108. Tacitus.—The Histories. *Twice a week; second semester. One unit.*

Professor BARTON

109. Vergil.—*Twice a week; first semester. One unit.* Professor PEASE

110. Bibliography and Criticism.—(Thesis course; the same as Greek 110.) *Once a week; both semesters. One unit.*

Professors OLDFATHER, PEASE, and others

113. Plautus.—*Twice a week; second semester. One unit.*
Professor OLDFATHER

115. Roman Elegy.—*Twice a week; second semester. One unit.*
Professor CANTER

Courses for Graduates and Advanced Undergraduates

8. Tacitus.—The Annals; books I-VI. *Three times a week; second semester.*
Professor PEASE

16. Martial and Suetonius.—Selections. *Three times a week; first semester.*
Professor BARTON

DAIRY HUSBANDRY

Candidates for the master's degree may take their major work in dairy husbandry, preparing a thesis in the field of dairy bacteriology, dairy chemistry, or milk production. Such students must have had at least 10 semester hours of previous work in dairy husbandry, including adequate preparation for the desired graduate courses.

Candidates for the master's degree desiring a minor in dairy husbandry must have had the introductory work regularly required to enter the desired course or courses.

Candidates who desire to register for a doctorate with their major interest in dairy bacteriology as well as those who desire to take dairy bacteriology as a part of a minor for the doctorate should register in bacteriology according to the regulations given under bacteriology.

Courses for Graduates

101. Economic Milk Productions.—Efficiency of dairy farms; factors influencing profits. *Twice a week; both semesters. One or two units.*
Professor FRASER

106. Dairy Bacteriology.—Research on assigned problems. *Both semesters. One-half to two units.*
Professor PRUCHA

107. Dairy Chemistry.—Assigned problems. *Once a week; both semesters. One unit.*
Assistant Professor OVERMAN

108. Physiology of Milk Production.—*Once a week; first semester. One-half to two units.*
Professor GAINES

Courses for Graduates and Advanced Undergraduates

4. Ice Cream Making.—Lectures; laboratory. *Three times a week; second semester.*
Professor RUEHE, Mr. AMBROSE

5. Composition of Dairy Products.—Lectures; recitations; problems; assigned reading; laboratory. *Three times a week; second semester.*
Assistant Professor OVERMAN

7. Creamery Buttermaking and Factory Management.—Lectures; laboratory. *Six times a week; second semester.*
Professor RUEHE, Mr. AMBROSE

10. Dairy Bacteriology.—Study of some of the more important relations of bacteria to milk and its products. Lectures; laboratory. *Three times a week; first semester.* Professor PRUCHA

17. Advanced Study of Dairy Breeds.—Lectures; assigned reading; seminar work. *Twice a week; first semester.* Assistant Professor YAPP

20. Economic Problems in Dairy Farming.—*Three times a week; first semester.* Professor FRASER

21. Economic Milk Production.—*Five times a week; second semester.* Professor FRASER

ECONOMICS

Every student entering on major graduate work in economics must have had a course in the principles of the science and also in some special part of the field such as public finance or money and banking. The work must represent at least eight semester hours. He must also have had at least one semester's work in English, American, or general European history; and at least three hours in political science.

Those who take the subject as a minor must have had a course of at least five semester hours in the principles.

Graduate students who are making economics their major are required during their first year to acquaint themselves with the works of the masters in the science, either by taking course 101 or by private reading for examination. In the second or third year they are expected to elect course 105 and some fundamental course in political science and sociology unless they have already had such courses.

The following courses may be taken by students in general economics for major or minor credit: all numbered above 100; 4, 5, 10, 11, 12, 13, 14, 15, 17, 19, 20, 21, 29, 32, 61. The following may be taken for minor credit only: 8, 8c, 9, 28, 31.

Two units will be accepted for a first minor for the master's degree; and four two or three hour graduate courses, or their equivalent in advanced undergraduate courses, for a first minor for the doctor's degree.

Courses in transportation may be included in their programs by students of economics as part of either their major or minor subjects. See Transportation.

Courses for Graduates

101. Economic Theory.—*Twice a week; both semesters. One unit.* Professor WESTON

104. Foreign Commerce.—*Twice a week; both semesters. One unit.* (Not given 1921-22). Professor LITMAN

105. Public Finance.—*Twice a week; both semesters. One unit.* Assistant Professor HUNTER

107. The Corporation in Economic Evolution.—*Twice a week; both semesters. One unit.* Professor ROBINSON

109. Theory of Industrial Consolidation.—The nature, causes, and effects of industrial consolidation; prices, profits, and wages. *Twice a week; both semesters. One unit.* (Not given, 1921-22). Professor ROBINSON

110. Investments.—Nature, character, and function of investments; classes including direct investment and securities of various types; methods of judging investments; state control. *Twice a week; both semesters. One unit.* (Not given, 1921-22). Professor ROBINSON

112. Labor Problems.—*Twice a week; both semesters. One unit.*
Associate Professor WATKINS

118. Seminar.—Bi-weekly discussion of the results of student's investigations.
Members of the Staff

122. Advanced Economic History of the United States.—*Twice a week; both semesters. One unit.* Professor BOGART

Theory of Statistics.—See Mathematics 129.

Courses for Graduates and Advanced Undergraduates

8c. Foreign Exchange and the Money Market.—*Three times a week; second semester.* Professor WESTON

9. Advanced Banking, Theory and Practise.—*Three times a week; first semester.*
Professor WESTON

10. Corporation Management and Finance.—*Three times a week; second semester.*
Professor ROBINSON

11. Industrial Consolidation.—Development; plans for controlling trusts. *Twice a week; first semester.* Professor ROBINSON

14. Agricultural Co-operation.—*Twice a week; second semester.*
Assistant Professor WRIGHT

15. Financing Agriculture.—*Twice a week; second semester.*
Assistant Professor WRIGHT

17. Economic History of Agriculture.—*Twice a week; second semester.* (Not given, 1921-22.) Assistant Professor WRIGHT

24. Economic Development of Modern Europe.—*Three times a week; first semester.* Professor BOGART

28. Mechanism and Technic of Domestic Commerce.—*Three times a week; first semester.* (Not given, 1921-22.) Professor LITMAN

29. International Trade and Trade Policies.—*Twice a week; second semester.* (Not given, 1921-22.) Professor LITMAN

31. Organization of Foreign Commerce.—Exporting and importing; means of communication and of transportation; the shipping business; duties of consuls. *Three times a week; second semester.* (Not given, 1921-22). Professor LITMAN

32. Marketing and Prices of Agricultural Products.—*Twice a week; first semester.*
Assistant Professor WRIGHT

41. Labor Problems.—*Three times a week; first semester.*
Associate Professor WATKINS

42. Labor Legislation.—*Three times a week; second semester.*
Associate Professor WATKINS

43. Personnel Administration.—*Three times a week; first semester.*
Associate Professor WATKINS

44. Socialism and Economic Reform.—*Twice a week; second semester.*
Associate Professor WATKINS

51. Public Finance.—*Three times a week; first semester.*
Assistant Professor HUNTER

52. Taxation.—*Three times a week; second semester.*
Assistant Professor HUNTER

61. Economic Theory.—*Twice a week; both semesters.*
Professor THOMPSON

EDUCATION

Students who elect education as a major subject must have completed at least a three-hour course in the principles of education, a course of at least the same length in the history of education, and a minimum of three hours each in psychology and philosophy. For graduate students who have had experience in teaching, these requirements may be modified.

Courses for Graduates

101. Seminar in Educational Theory.—*Once a week, two hours; first semester. One unit.* Professor CAMERON

102. Research in History of American Education.—*Once a week, two hours; first semester. One unit.* Associate Professor SEYBOLT

103. Research in History of American Education.—*Once a week, two hours; second semester. One unit.* Associate Professor SEYBOLT

104. Seminar in Educational Administration.—*Once a week; two hours; second semester. One unit.* Dean CHADSEY

105. Seminar in Modern European Education.—*Once a week, two hours; first semester. One unit.* Associate Professor SEYBOLT

106. Seminar in High School Administration.—*Once a week, two hours; second semester. One unit.* Assistant Professor BELTING

118. Seminar in Theory of Educational Measurements.—*Three times a week; first semester.* Professor MONROE

121. Seminar in Educational Measurements.—*Once a week; two hours; second semester. One unit.* Associate Professor MONROE

125. Seminar in Educational Psychology.—Psychology of school subjects. *Once a week, two hours; first semester. One unit.* Professor CAMERON

Courses for Graduates and Advanced Undergraduates

4. Problems of Educational Administration.—Interpretation of present tendencies. *Three times a week; first semester.* Dean CHADSEY

6. Principles of Secondary Education.—*Three times a week; first semester.*
Assistant Professor BELTING

11. The Intellectual Life of the Ancient World.—*Three times a week; first semester.* Associate Professor SEYBOLT

12. History of American Education.—*Three times a week; second semester.*
Associate Professor SEYBOLT

16. Educational Finance.—*Three times a week; second semester.*
Professor ————

20a. Supervision of Secondary Education.—*Three times a week; first semester.*
Assistant Professor BELTING

23. Educational Statistics.—*Three times a week; first semester.* (Not given, 1921-22). Professor MONROE

27. High School Curriculums.—*Three times a week; second semester.*
Assistant Professor BELTING

28. The Project Method of Teaching.—*Twice a week; first semester.* (Not given, 1921-22).

41. Vocational Education.—*Three times a week; first semester.*
Professor ————

43. Mental Tests.—Laboratory drill; tests of sensory capacities; attention; memory; learning; suggestibility; inventiveness; system of tests for diagnosis of mental age, general intellectual status; mental retardation. *Twice a week; second semester.* Professor CAMERON

44. Educational Psychology.—(Laboratory Course.) *Twice a week; first semester.*

45. Problems in Educational Psychology.—*Time to be arranged; first semester.*
Professor CAMERON

51. Teachers' Course in Agriculture.—*Three times a week; first or second semester.*
Associate Professor NOLAN

ELECTRICAL ENGINEERING

The prerequisite for graduate work in electrical engineering is the equivalent of the undergraduate courses required for the degree of Bachelor of Science in electrical engineering in the branches of the subject in which registration is desired.

Graduate students who wish to take a minor in electrical engineering must have had differential and integral calculus, and one year's work in college physics.

Courses for Graduates*

101. Advanced Course in Alternating Currents.—The theory of transient phenomena; polyphase circuits; measuring apparatus. *Twice a week; both semesters. One and one-half units.* Professor PAINE

103. Electrical Designs.—Plans for an electrical machine or apparatus of specified character; or for the arrangement of an electrical plant; or for the installation of such machinery or apparatus. *Twice a week; second semester. One unit.*
Assistant Professor WALDO

105. Electrical Engineering Research.—Investigation of electrical phenomena, or test of some electrical machine or apparatus. *Twice a week; both semesters. One to three units.* Professor PAINE, Professor BROOKS

*Courses offered to Junior and Senior students are open for minor credit to students majoring in other fields.

ENGLISH LANGUAGE AND LITERATURE

Students who enter on graduate work with English as their major subject are required to give evidence of their ability to write good English. They must present the equivalent of fourteen hours of undergraduate work in English literature, the required college work in rhetoric, and the equivalent of four semesters of college work in a language other than English. After the first year of graduate work a knowledge of French and German is indispensable.

Students making English their minor may be admitted to such courses as in the judgment of the instructor in charge they are qualified to pursue.

The Degree of Master of Arts in English.—In addition to complying with the general rules of the Graduate School, candidates for the degree of Master of Arts in English must comply with the following rules of the Department of English: (1) they must choose a portion of their work from the group of courses described as "for graduates;" (2) must offer an elementary course in Anglo-Saxon; and (3) must take, besides the regular semester examinations in all their courses, a general examination, oral or written as the department may prescribe, which shall be a final test of the candidate's fitness and ability.

The Degree of Doctor of Philosophy in English.—Candidates for the degree of Doctor of Philosophy in English may expect to be examined on the entire field of the English language and literature. They are urged, furthermore, to acquaint themselves as fully as possible with the history and philosophy of the period in which their main interest lies, and with the foreign languages and literatures most closely related to English in that period.

Courses for Graduates

101. Research in Special Topics.—*One or two units.* Professors Sherman, Dodge, Bernbaum, Flom, Paul, Associate Professors Scott, Jones, Zeitlin, Assistant Professors Baldwin, Hillebrand, Boyer, Rinaker, Drs. Parry, Bundy.

102. A critical and bibliographical survey of English literature from the Old English period to the nineteenth century. Primarily for candidates for the Master's degree. *Twice a week; arrange time. One unit.* Dr. Rinaker

113. History of English Prose.—The forces, native and foreign, in the development of its vocabulary, syntax, and style. *Twice a week; both semesters.*
Associate Professor Zeitlin

114. The Development of the Essay.—The English essay; continental influences; classical origins. *Twice a week; both semesters. One unit.*
Associate Professor Zeitlin

120. The History and Principles of Literary Criticism.—A study of the most important theories of poetry. *Twice a week; One unit.*
Dr. Bundy

127. Metrical Romances.—The beginnings of verse fiction. *Twice a week; second semester. One unit.* (Not given, 1921-22.)

128. Literature of the Sixteenth Century.—*Twice a week. One unit.*
Associate Professor Jones

129. English Literature from Norman Conquest to Chaucer.—Middle English authors exclusive of Chaucer. *Twice a week; both semesters. One unit.* (Not given, 1921-22.) Associate Professor JONES

135. Problems in American Literature.—Poe, Lowell. *Twice a week; both semesters. One unit.* (Not given, 1921-22.) Professor PAUL

136. The Transition from the Seventeenth to the Eighteenth Century, 1675-1725; the Rise of Classicism.—*Twice a week; both semesters. One unit.* Professor PAUL

137. Prose Writers of the Nineteenth Century.—Relation of literature to social forces; Mill, Carlyle, Newman, Ruskin, Arnold, and Pater. *Twice a week; both semesters. One unit.* Professor SHERMAN

138. The Romantic Movement in England.—*Twice a week; both semesters. One unit.* (Not given, 1921-22.) Professor SHERMAN

139. The Sonnet Revival in the Eighteenth Century.—Special topics for investigation and report, with emphasis on methods of research. *Twice a week; first semester.* (Not given, 1921-22.) Assistant Professor RINAKER

140. Investigations in Modern English Literature.—(For second-year and third-year graduate students who are preparing theses for the doctor's degree.) *Three hours once a week; both semesters. One to three units.* (May be taken in successive years.) Professor BERNBAUM

141. The History of Seventeenth Century English Literature to About the Year 1675.—Poetry, beginning with Shakespere's Sonnets. *Twice a week; both semesters. One unit.* (The first semester may not be taken separately.) Professor BERNBAUM

143. The Origins of the English Novel, and Its History to the End of the Eighteenth Century.—*Twice a week; both semesters. One unit.* (The first semester may not be taken separately.) Professor BERNBAUM

144. Lincoln's Letters and Speeches.—Development of style, relation to period, textual study, contemporary estimates. *Twice a week; second semester. One unit.* (Not given, 1921-22.) Professor DODGE

Courses for Graduates and Advanced Undergraduates

A. English Literature and Language

3. The Poetry of Milton.—Origins, forms, artistic and ethical values; Milton's place in English literary history. *Three times a week; second semester.* Assistant Professor BALDWIN

4. English Versification.—Verse forms; reading of representative poems. Verse composition; individual conferences. *Three times a week; first semester.* (Not given, 1921-22.)

5. Shakespeare.—Six plays, with special emphasis on *Hamlet. Three times a week; second semester.* Professor DODGE

8-9. Old English (Anglo-Saxon).—Grammar; prose; short poems; *Beowulf.* (The first semester may be taken separately.) *Three times a week; both semesters.* Professor DODGE

17. **The English Language.**—History, characteristics, and usage of modern English. *Three times a week; second semester.* Associate Professor ZEITLIN

18. **Modern English Grammar.**—Sentence structure and analysis; grammatical categories; peculiarities of English syntax. *Three times a week; second semester.* (Not given, 1921-22.) Associate Professor ZEITLIN

25. **Chaucer.**—*Three times a week; first semester.* Associate Professor JONES

26. **Spenser.**—*Three times a week; second semester.* Associate Professor JONES

27. **English Literary Periodicals and the Genesis of the Periodical Essay in the 17th and 18th Centuries.**—*Twice a week; second semester.* (Not given 1921-22.) Associate Professor SCOTT

28. **The Magazine in America.**—*Twice a week; second semester.* Associate Professor SCOTT

30. **History of the American Newspaper.**—*Twice a week; first semester.* Associate Professor SCOTT

35. **The English Drama from the Beginning to 1600.**—[*Exclusive of Shakespeare*]—The Religious Drama, Morality Plays, Sackville, Udall, Lyly, Peele, Greene, Kyd, Marlowe, etc. *Three times a week; first semester.* Professor DODGE

36. **The English Drama from 1600 to 1700** [*Exclusive of Shakespeare*].—Jonson, Chapman, Dekker, Marston, Heywood, Middleton, Beaumont and Fletcher, Webster, Ford, Massmyer, Dryden, Wycherley, Vanbrugh, Congreve, etc. *Three times a week; second semester.* Assistant Professor HILLEBRAND

38. **The Arthurian Tradition.**—The historical Arthur; Celtic influences; Old French Romances (in translation); the tradition in England to the present time, with especial attention to Malory and Tennyson. *Twice a week; second semester.* (Not given, 1920-21.)

39. **Introduction to the Literature of the Middle Ages.**—Classical influences. Principal types; epic, romance, legend, lay, allegory, fabliau, lyric. Important poems, both English and continental, will be read in translation. *Three times a week; second semester.* Dr. PARRY

45. **The Development of the Modern Drama.**—Dramatic tendencies in the Nineteenth century, both in England and on the Continent. *Three times a week; first semester.* Assistant Professor HILLEBRAND

49. **Literary Treatment of Economic and Social Problems, 1770-1870.**—*Three times a week; second semester.* Assistant Professor BOYER

52. **The Great Novelists of the Nineteenth Century.**—Scott, Jane Austen, Dickens, Thackeray, Hawthorne, George Eliot, Meredith, Hardy, Stevenson. *Three times a week; second semester.* Professor BERNBAUM

53. **Mathew Arnold.**—His prose and poetry with special reference to the main currents of nineteenth century thought. *Three times a week; second semester.* Professor SHERMAN

54. **Introductory and Comparative Survey of the Greatest Greek, Latin, Italian, Spanish, French, German, and English Authors.**—*Three times a week; both semesters.* Professors OLDFATHER, OLIVER, FITZ-GERALD, LESSING, and BERNBAUM, and Assistant Professor VAN HORNE.

The second semester may not be taken separately.

The assigned reading may be done in translation.

60a-60b. Thesis.—Special training in investigation for candidates for honors and for other seniors. *Once a week; both semesters.*
Associate Professor ZEITLIN, and others

B. Rhetoric

17. Advanced Composition.—Practise writing, with special emphasis on structure; criticism of current periodical literature; development of material for reports, magazine articles, etc. (Open to a limited number of students, and only on recommendation.) *Three times a week; second semester.* Assistant Professor BOYER

C. The Scandinavian Languages

Preparation for major graduate work in the Scandinavian languages or literature must include a good knowledge of one of the Scandinavian languages and systematic work in the undergraduate courses in Scandinavian. Any graduate student in language may, however, be admitted to the purely philological courses.

Courses for Graduates

101. Old Norse.—Introduction to the language. Reading of the *Prose Edda. Twice a week; both semesters. One unit.* Professor FLOM

103. Old Swedish.—Noreen's grammar and reader is used. *Twice a week; second semester. One unit.* Professor FLOM

110. Advanced Old Norse.—Lays of the *Elder Edda* and selections from the *Speculum Regale* (*Konungs Skuggsja*). *Twice a week; both semesters. One unit.* (Not given, 1921-22.) Professor FLOM

140. Early Scandinavian Paleography.—(The work is based on the facsimiles and photographs of manuscripts in the Scandinavian Collection of the University library.) Old English script will also be briefly considered. *Twice a week; second semester. One unit.* (Not given, 1921-22.) Professor FLOM

150. Research.—Special problems in Scandinavian philology or literature. *Once a week; first semester. One-half to two units.* Professor FLOM

Courses for Graduates and Advanced Undergraduates

14. History of Old Norse Literature.—The mythical lays, the court poetry, the sagas, the ballads. *Twice a week; second semester.* Professor FLOM

16. Introduction to the History of Early Scandinavian Culture.—The civilization of Scandinavia in the Ages of Stone, Bronze and Iron down to the close of the Viking migrations and the introduction of the Latin script. *Twice a week; first semester.* Professor FLOM

ENTOMOLOGY

The prerequisite for graduate work in entomology is two years of undergraduate biology, of which one year should be zoology. Entrance on major work in entomology requires Entomology 15 or its equivalent. A reading knowledge of French and German is necessary at least by the beginning of the second year.

Courses for Graduates

102. Research in the Morphology and Embryology of Insects.—*Twice a week; both semesters. One or two units.* Assistant Professor FOLSOM

108. Research in Economic Entomology.—*Once or twice a week; both semesters. One or two units.* Professor METCALF, Assistant Professor FOLSOM

109. Research in Systematic Entomology.—*Twice a week; both semesters. One or two units.* Professor MACGILLIVRAY

110. Research in the Biology and Ecology of Insects.—*Twice a week; both semesters. One or two units.* Professor METCALF

Courses for Graduates and Advanced Undergraduates

10. Taxonomy of Immature Insects.—External form of immature insects; identification of species. *Three times a week; both semesters.* Professor MACGILLIVRAY

11. Classification of the Coccidae.—Preparing scale insects for study; identification of genera and species; morphology, metamorphosis, and phylogeny. *Three times a week; both semesters.* (Not given, 1920-21.) Professor MACGILLIVRAY

15. Introductory Course.—Metamorphosis and development of insects; orders, suborders, and families; habits of species; anatomy of immature and adult insects; special adaptive structures; classification of insects. *Three times a week; first semester.* Professor MACGILLIVRAY

17. Insect Organogeny.—Adult and immature insects. *Three times a week; both semesters.* Professor MACGILLIVRAY

18. Insect Taxonomy.—Structures used in the classification of insects; identification of a representative collection of insects. *Five times a week; both semesters.* Professor MACGILLIVRAY

FRENCH

(See Romance Languages)

GENETICS

Instruction in courses leading to advanced degrees in genetics is offered by the departments of agronomy, animal husbandry, botany, horticulture, and zoology. The work is offered under the supervision of a committee representing these departments.

The prerequisites for major work in genetics are Botany 1 and 3a, Mathematics

2 and 4, and Zoology 1 and 2, or their equivalents. A reading knowledge of German and French is indispensable.

The prerequisite for minor work in genetics is 10 hours of botany or zoology.

Courses for Graduates

Agronomy

112. Advanced Plant Breeding.—Genetics of crop plants, genetic interpretation of inheritance of size, yield, disease resistance, and of effects of selection; linkage; and correlated characters; multiple allelomorphs. *Lecture, twice a week; second semester.* Assistant Professor WOODWORTH

118. Investigation.—A special problem is chosen by each student. Consultation one to five times a week for different students. *Both semesters. One to four units.* Assistant Professor WOODWORTH

Animal Husbandry

117. Genetic Experiments on Animals and Plants.—A survey of the biological and mathematical methods employed. *Two to five times a week; both semesters. One to two units.* Professor DETLEFSEN

112e. Research.—Experimental investigations in heredity and variation. (This course may be taken during the summer by special permission.) *Once a week; both semesters. One to two units.* Professor DETLEFSEN

Botany

101. Individual Plant Development.—Origin of the individual; external and internal factors in its development and physiologic performance; response of the cell, somatic and generative, to external factors. *Once a week; both semesters. One to two units.* Professor HOTTES

Zoology

115. Factors of Individual and Racial Development.—Experimental embryology; regeneration; heredity; variation; evolution. *Twice a week; both semesters. One unit.* Professor ZELENY

124. Experimental Zoology.—Individual research course. *Both semesters. One to two units.* Professor ZELENY

Courses for Graduates and Advanced Undergraduates

Agronomy

22. Plant Breeding.—The improvement by breeding of field crops, including grains, grasses, and legumes. With practical application. *Twice a week, first semester.* Assistant Professor WOODWORTH

Animal Husbandry

30. Genetics.—Heredity, variation, elements of biometry, and their practical application to breeding. *Five times a week; first semester.* Professor DETLEFSEN

Botany

14a-14b. Heredity, Variation, Evolution.—Cells and members of plants; adaptations and changes; mechanism of heredity; evolution. *Twice a week; both semesters.*
Professor HOTTES

Horticulture

12. Evolution of Horticulture Plants.—History, botanical classification, and geographical distribution of cultivated plants; modification under culture; variation. *Three times a week; first semester.* Professor CRANDALL

Zoology

25-26. Experimental Zoology.—Experimental embryology; regeneration; heredity; variation; evolution. *Two to five times a week; both semesters.* (See also Mathematics 29; Zoology 8, 20.) Professor ZELENY

GEOLOGY

For graduate work in geology the student must have had at least a major in geology and an acceptable field training. Other graduate students with adequate technical preparation may be admitted to certain graduate courses.

Under the present organization of the Department, the major field of study for the doctorate will be general geology. First and second minor subjects are available as follows: (a) historical geology, including stratigraphy and paleontology; (b) economic geology; (c) mineralogy and petrology; (d) physiography, including glaciology; (e) structural and metamorphic geology; (f) crystallography.

A first minor presupposes 4 units, and a second minor 2 units credit.

Courses for Graduates

101. Advanced Crystallography.—The methods used in measuring, projecting, and calculating crystal forms, and determining the physical properties of crystallized bodies. *Twice a week; both semesters. One unit.*
Professor BAYLEY

135. Research.—Individual work under the supervision of members of the staff in their respective fields. *Once a week; both semesters and summer. One to four units.* Professor BAYLEY, Associate Professor QUIRKE, Assistant Professor LEIGHTON.

Courses for Graduates and Advanced Undergraduates

95. Economic Geology.—The occurrence, origin, and uses of coal, oil, building stones and bedded deposits of economic importance. Lectures; quizzes, and laboratory. *Three times a week; first semester.* Professor BAYLEY

96. Economic Geology.—The nature, occurrence, and origin of metaliferous deposits. Theories of ore deposition. *Three times a week; second semester.*
Professor BAYLEY

42. Stratigraphic Paleontology.—The invertebrate index fossils of the successive geologic formations, from the Cambrian to the Tertiary. Field trip of 1-2 weeks required in the second semester. *Twice a week; both semesters.*
Professor SAVAGE

6. Optical Mineralogy.—Introduction to the microscopic study of minerals, by means of their behavior in polarized light. Two lectures; four hours laboratory. *Three times a week; first semester.* Professor BAYLEY and Mr. YEATON

7. Petrography.—The principles learned in Geology 6 applied to the study of rocks. The different types of rocks; their origin and classification. Study of representative suite of specimens in the hand specimen and thin section. *Three times a week; second semester.* Professor BAYLEY and Mr. YEATON

GERMANIC LANGUAGES AND LITERATURE

Students desiring to take German as a major are required to have finished successfully a four year's course of undergraduate work in German, comprising a minimum of twenty-eight semester hours of credit. They are also required to be familiar with the principal works of the writers of the classical and modern periods of German literature, to show a general knowledge of the history of German literature, and to be able to follow lectures in the German languages.

Of collateral subjects, a reading knowledge of Latin and French is required. It is desirable that candidates for the degree of Ph.D. have some knowledge of Greek. All students are to have had a course in German history.

Courses for Graduates

101. Seminar in Germanic Philology.—Training in original research. Results, when of value, may be published in the *Journal of English and Germanic Philology. Once a week; both semesters. One unit.* Professor GOEBEL

103. Introduction to the Historical Study of the Germanic Languages.—History of German philology; comparative grammar of the old Germanic dialects. *Twice a week; second semester. One unit.* Professor GOEBEL

104. Gothic.—Grammar and literature. *Twice a week; first semester. One unit.*
Professor GOEBEL

105. Old High German.—Grammar and interpretation of the oldest literary documents. *Three times a week; second semester. One unit.*
Assistant Professor WILLIAMS

109. Goethe's and Schiller's Philosophy.—*Twice a week; both semesters. One unit.* (Not given, 1921-22.) Professor GOEBEL

110. Early German Drama.—German drama up to the Reformation: medieval religious drama, Shrovetide plays, beginnings of the humanistic drama. *Twice a week; first semester. One unit.* Assistant Professor BROOKS

113. German Literature of the Fifteenth and Sixteenth Centuries.—Luther and the Reformation, Mastersingers and Folksong, the Reformation drama. Hans Sachs, Brant, Fischart, the chap books, the English comedians. *Twice a week; second semester. One unit.* Assistant Professor BROOKS

115. History of German Literature During the Nineteenth Century.—*Twice a week; both semesters. One unit.* Professor Lessing

116. Medieval German Literature with Reference to Political, Religious, and Social History.—Research course. *Twice a week; both semesters. One unit.* (Not given, 1921-22.) Professor Lessing

117. History of German Literature During the Eighteenth Century.—*Twice a week; both semesters. One unit.* (Not given, 1921-22.) Professor Goebel

118. The German Drama Since Schiller.—Research course. *Twice a week; both semesters. One unit.* Professor Lessing

119. The German Novel.—Research course. *Twice a week; both semesters. One unit.* (Not given, 1921-22.) Professor Lessing

121. Walther von der Vogelweide.—*Twice a week; second semester. One unit.* Professor Goebel

121b. Nibelungenlied.—*Twice a week; second semester. One unit.* (Not given, 1921-22.) Professor Goebel

125. History of the German Language.—Evolution of the forms, syntax, and lexicography of the High German literary language. *Three times a week; second semester. One unit.* (Not given, 1921-22.)

126. Herder and his relation to European Literature.—Research course. *Twice a week; both semesters. One unit.* Assistant Professor Koller

Courses for Graduates and Advanced Undergraduates

8. Schiller.—The life of Schiller; *Wallenstein* and other selections. *Three times a week; second semester.* Professor Lessing

19a-19b. Goethe's Faust.—The Faust legend and early Faust books and plays; the genesis of Goethe's *Faust*; reading of both parts. *Twice a week; both semesters.* Professor Goebel

26a. German Literature to the End of the Reformation.—*Three times a week; first semester.* Professor Lessing

26b. German Literature after the Reformation.—*Three times a week; second semester.* Professor Lessing

27. Lessing.—The life of Lessing; *Nathan der Weise, Emilia Gallotti* and other selections. *Three times a week; first semester.* (Not given, 1921-22.) Professor Lessing

31. Middle High German.—*Twice a week; first semester.* Professor Goebel

39a-39b. Goethe's Poems; Goethe's Tasso; Schiller's Critical Essays.—*Twice a week; both semesters.* Professor Goebel

GREEK

(See Classics)

HISTORY

Graduate work in history requires two years of college work in this subject, or sixteen semester hours, which should ordinarily include introductory courses in European and American history. Linguistic preparation is important especially in French and German. For medieval history some knowledge of Latin is essential, and Spanish is useful for certain fields of American history.

Advanced courses in history at the University of Illinois are of three kinds: (1) Courses for information and guidance in general reading. (2) Instruction in methodology, historiography, and bibliography. A part of this work (in course 103) is required of all graduate students in history during their first year. (3) Seminary courses for the study of special fields with a view primarily to training in the methods of historical criticism and research.

Illinois Historical Survey.—Students of history have an opportunity to pursue research in western history in connection with the Illinois Historical Survey, which is an organization for the purpose of carrying on systematic studies in the history of Illinois.

Attention is also called to the fact that the University of Illinois has for some time cooperated with the Trustees of the State Historical Library in the gathering and editing of archive material. As a result of this relation instructors and graduate students in the department have contributed from time to time to the publications of the Library and have been given useful training in the study of manuscript as well as of printed material.

Higher Degrees in History.—The following statement regarding the specific requirements for higher degrees in history is subject to the general requirements of the Graduate School.

Master of Arts

In addition to meeting the usual tests in the specific courses taken, each candidate is required to pass a general oral examination, and written examinations in two of the following fields: ancient history; medieval history of continental Europe; modern history of continental Europe; English history; American history. Candidates for this degree are expected to have a general knowledge of historical bibliography and methodology (see course 103).

Doctor of Philosophy

Major Requirements.—A candidate who selects history as his major subject may offer himself for examination in any four of the fields indicated below, stating also the particular field among these four in which he wishes to specialize and in which his thesis is to be written:

1. Ancient history. 2. Medieval history and institutions of continental Europe, to the close of the thirteenth century. 3. Continental Europe from 1300 to 1648. 4. Continental Europe and its dependencies since 1648 (except as included in 5 and 6). 5. The history of England and its dependencies, (not including America before 1783). 6. American history (except as included in 5, and with primary reference to the United States). This enumeration of fields is not to be regarded as excluding the possibility of accepting others as may be determined by the department in individual cases.

Minor Subjects.—A candidate for the doctorate in history may select as his first minor one of the divisions of the field of history listed above which is not offered as a part of his major. He should preferably, however, select his minors from subjects offered by other departments. The following list of suitable minors is intended to be suggestive rather than exhaustive or compulsory.

I. In Political Science.—(Any two acceptable for a first minor; any one, for a second minor): 1. International law and diplomacy. 2. Modern government. 3. Municipal government. 4. Constitutional and administrative law and jurisprudence. 5. Political theory.

II. In Economics and Sociology.—(Any two acceptable for a first minor; any one, for a second minor): 1. Economic history. 2. Economic theory. 3. Public and private finance. 4. Social reform. 5. Principles of sociology.

III. In Philosophy and Education.—(Any two acceptable for a first minor; any one, for a second minor): 1. History of ancient and medieval philosophy. 2. History of modern philosophy. 3. History of education.

IV. In Literature.—Some division of the history of literature which may be either comparative literature of a limited period or the literature of a particular country for a more extended period as may be agreed upon in each case.

Courses for Graduates

101. Seminar in American History.—Guidance in the investigation of selected topics. Consultations with individual students and general meetings of faculty and students. *Two hours, once a week; both semesters. One to two units.*

Professor Greene and others

In connection with this course, advice and direction in research are offered in various fields as follows:

A. American history before 1815. Professor Greene

B. American history since 1815.
Professor Robertson, Assistant Professor Randall

C. The history of the west. Assistant Professor Pease

D. American church history. Professor Greene

E. Latin-American history. Professor Robertson

102. Seminar in English History.—Church and state in the medieval and early modern period; examination of documentary materials. *Arrange hours; both semesters. One unit.*

Professor Larson

103. Historiography and Historical Method.—The technic of historical investigation. Required of all candidates for an advanced degree in history who do not present evidence of similar training elsewhere. *Twice a week; first semester. One-half unit.*

Assistant Professor Randall

104. Seminar in European History.—European expansion. Bibliography, historiography, and selected problems; reports. *Two hours, once a week; both semesters. One to two units.* (Not given, 1921-22.)

Professor Lybyer, Associate Professor Jones

In connection with this course, advice and direction in research in various fields are offered as follows:

A. Modern history of continental Europe. Professor LYBYER

B. Renaissance and Reformation. Associate Professor JONES

C. Asiatic Relations. Professor GREENE, Professor LYBYER

110. Introduction to Research in American History.—Survey of sources and secondary authorities; study of typical problems. *Two hours, once a week; first semester. One unit.* Professor GREENE

111. Spanish-American Relations.—The relations of the Latin-American states with Europe and the United States; the Monroe doctrine; the development of international trade, etc. *Once a week, both semesters. One unit.* Professor ROBERTSON

112. Studies in American Religious History.—Selected topics in the history of church and state relations. *Arrange hours; second semester. One unit.* Professor GREENE

150. Research in Oriental History.—*Arrange hours; both semesters. One unit.* Professor OLMSTEAD

Courses for Graduates and Advanced Undergraduates

4a-4b. Constitutional History of England.—Institutional origins; modern constitutional practise. *Three times a week; both semesters.* Professor LARSON

9a-9b. European Society in the Era of the Renaissance and the Reformation.—The transition from medieval to modern ideals. *Twice a week; both semesters.* (Not given, 1921-22.) Associate Professor JONES

14a-14b. Studies in the Development of American Ideals.—I. The European inheritance and its modifications under American conditions, 1606-1776. II. Republican principles in society and politics, 1776-1828. *Twice a week; both semesters.* Professor GREENE

14c-14d. Studies in the Development of American Ideals.—III. Issues of democracy and materialism, 1829-1870. IV. Changing conceptions of democracy and the state; materialism and the international outlook. *Twice a week; both semesters.* (Not given, 1921-22.) Professor GREENE

15. The Civil War and the Reconstruction.—The ante-bellum South and its destruction, 1844-1870. The Civil War in the light of the forces which tended to hasten or obstruct the clash of arms. *Three times a week; second semester.* Assistant Professor RANDALL

21. Recent History of the United States.—Historical introduction to contemporary American politics; economic, political, and social problems; international relations; the United States on the eve of the Great War. *Twice a week; first semester.* Professor ROBERTSON

22a-22b. The Old Northwest, 1787-1865.—The settlement of the Northwest; western economic, political, and social problems; influence of the West on national policies. *Twice a week; both semesters.* Assistant Professor PEASE

23a-23b. The Puritan Revolution in England and America.—The influence of Puritanism on the institutions and ideas of England and America. English politics and political thought considered as a background to political theory in the American Revolution. *Twice a week; both semesters.* Assistant Professor PEASE

26. History of the Latin American Colonies.—Political, economic, social, and intellectual life in Spain and Portugal during the age of discovery. The colonization, administration and civilization of Latin America and the Philippines. The independence of Brazil and the Spanish American republics. *Three times a week; first semester.* Professor ROBERTSON

27. History of Latin America from the Wars of Independence to the Present Time.—The national history of the leading Latin American nations with special attention to existing governments, political parties, present economic and social conditions, and relations with the United States. *Three times a week; second semester.* Professor ROBERTSON

29a-29b. The Far East.—The contact of Western nations with the Far East from the Portuguese establishments of the sixteenth century to the present time, with special reference to China and Japan. *Three times a week; both semesters.* Professor GREENE

30a-30b. The Ottoman Empire and the Question of the Near East.—The rise and greatness, and the beginning of the decline, of the Turkish power, 1300 to 1792. Turkey since 1792, with special attention to internal condition and international relations. *Twice a week; both semesters.* (Not given, 1921-22.) Professor LYBYER

31a-31b. The Mohammedan World.—Mohammed, the Saracen Empire, and the Moslem civilization, before the crusades. The history and culture, since the first crusade, of the Mohammedan peoples in Europe, Africa, and Asia, except the Ottoman Turks. *Twice a week; both semesters.* (Not given, 1921-22.) Professor LYBYER

33a. Recent European History, 1848-1891.—The period of national consolidation and world-wide expansion. *Three times a week; first semester.* (Not given, 1921-22.) Professor LYBYER

33b. Recent European History, 1891 to Date.—The formation of alliances, the Balkan Wars, and the Great War. *Three times a week; second semester.* (Not given, 1921-22.) Professor LYBYER

34. European Consolidation and Colonial Expansion, 1648-1789.—*Three times a week; first semester.* Dr. SWAIN

35. The French Revolution, Napoleon, and the European Reaction, 1789-1848.—*Three times a week; second semester.* Dr. SWAIN

40. The History of the British Commonwealth.—Conditions that led to English expansion; imperial institutions; development of the Colonial Nations. *Twice a week; first semester.* Professor LARSON

42. Medieval Civilization.—A study of intellectual conditions and movements in the Middle Ages. *Twice a week; first semester.* Professor LARSON

46a-46b. The History of the Industrial Revolution in Great Britain, 1750-1921.—A study of the economic forces that have helped to shape contemporary English life. *Twice a week; both semesters.* Assistant Professor DIETZ

53. Assyrian History.—Sources, political thought, government of dependencies, parallels to more modern imperial states, and economic life of the Assyrian Empire. *Three times a week; second semester.* Professor Olmstead

60. The United States in the Great War.—A study of the course of the United States in the Great War (as neutral and participant) with particular attention to the economic mobilization and the administrative features of the American war government. *Three times a week; second semester.*

Assistant Professor Randall

HOME ECONOMICS

This department offers graduate work along two lines, one dealing with the application of the biological and physical sciences to the problems of food and nutrition; the other with the economic problems of the household. In either case the student must offer a minimum of ten hours' work with food, eight with textiles and clothing, five with the house, eight of chemistry, eight of biological science, and three in the principles of economics. In addition each student must offer five additional hours in economics or a second year of chemistry, including quantitative and organic chemistry, according to the line of specialization.

Courses for Graduates

101. Home Economics.—Vocational, educational and sociological aspects. *Twice a week; first semester. One unit.* Professor————

102. Special Investigation.—Application of the principles of bacteriology, chemistry, and physiology to the ordinary processes used in the preparation of food; problems in metabolism and nutrition. *Twice a week; both semesters. One to two units.* Assistant Professor Wardell

103. Seminar.—Recent advances in nutrition. Students registering for this course should have a reading knowledge of French or German. *Once a week; both semesters. One-half unit.* Assistant Professor Wardell

104. Economic Problems of the Family Group.—The economic phases of selected problems of the household. *Twice a week; both semesters. One unit.* (Not given, 1921-22.)

Courses for Graduates and Advanced Undergraduates

4. Food and Nutrition.—Application of the principles of science to the problems of food and nutrition. *Five times a week; first semester.*

Assistant Professor Wardell

20. Infant Nutrition.—*Twice a week; second semester.*

Assistant Professor Wardell

28. Organization and Management of the Household.—(Continuation of Home Economics 10.) The relation of the home to public activities; retail market organization; cooperative buying and housekeeping; community kitchens; laundries. *Twice a week; second semester.* (Not open to graduate students in 1921-22.)

HORTICULTURE

At least twenty hours of collegiate work in horticulture and allied subjects and specific preparation for the chosen topics are required for entrance on major work in this department.

Courses for Graduates

103. Olericulture.—Special problems in vegetables. *Both semesters. One to two units.* Professor Lloyd

108. Pomology.—Special problems in small fruits and orchard fruits. *Both semesters. One to two units.*
Professor Blair, Professor Crandall, Professor Lloyd, Professor Pickett

115. Floriculture.—The horticultural status of flowering plants, or special problems in the culture of greenhouse plants. *Both semesters. One to two units.* Professor Dorner

116. Nutrition of Greenhouse Plants.—Lectures and special problems. *Both semesters. One unit.* Assistant Professor Lehenbauer

Courses for Graduates and Advanced Undergraduates

8. Orcharding.—Pomaceous, drupaceous, and nut fruits; management of large commercial orchards. *Five times a week; first semester.* Professor Pickett

12. Evolution of Horticultural Plants.—History, botanical classification, and geographical distribution of cultivated plants; modification under culture; theoretical causes and observed factors that influence variation. *Three times a week; first semester.* Professor Crandall

17. Commercial Orcharding.—(Continuation of Horticulture 8.) Production and business methods in large orchards; reference readings; seminar. A required trip will be taken, cost not to exceed $10.00. For students specializing in pomology. *Five times a week; second semester.* Professor Pickett

18. Experimental Horticulture.—Methods and difficulties in horticultural investigations; the planning of experiments; recording and interpretation of results. (For advanced students preparing for experiment station work.) *Five times a week; second semester.* Professor Blair, Professor Pickett

43. Greenhouse Fertilizers.—Soils and fertilizers; moisture and carbon dioxide content of the air; temperature as related to greenhouse crops. *Three times a week; first semester.* Assistant Professor Lehenbauer

44. Pomology Seminar.—Assigned topics; review of books, current technical journals, and other publications. For seniors and graduates specializing in pomology. *Once a week; both semesters.*
Professor Pickett, Assistant Professor Ruth

45. Plant Nutrition.—Carbohydrates, proteins, organic acids, and other organic compounds of plants and their relation to plant nutrition. *Three times a week; second semester.* Assistant Professor Lehenbauer

46. Marketing Horticultural Products.—Fruits and vegetables. Required inspection trips, expenses about $20.00. For seniors and graduates specializing in horticulture. *Three times a week; first semester.* Professor Lloyd

MATHEMATICS

Students entering on graduate study with a major in mathematics must have had twenty-five hours of undergraduate work in mathematics, including a year's course in calculus and a course in theory of equations, or in differential equations. They should be able to read German and French.

Candidates for a doctor's degree taking a first minor in mathematics are expected to have completed a course in calculus and are required to take two one-year courses beyond the calculus; candidates for a doctor's degree taking a second minor are required to complete at least one course throughout a year beyond the calculus.

The courses offered by the department are arranged in cycles of two or of three years, so that a student will have opportunity to take any particular course offered by the department, for which he is qualified, in three years of residence required for the doctor's degree.

Courses for Graduates

100. Seminar.—*Three times a week; both semesters. One to two units.* Professor Townsend, Professor Miller, Professor Shaw, Professor Coble, Professor Carmichael, Associate Professor Emch, Assistant Professor Crathorne, Assistant Professor Kempner, Assistant Professor Wahlin, Assistant Professor Blumberg.

101. Functions of Real Variables.—*Three times a week; both semesters. One unit.* (Not given, 1921-22.) Professor Townsend

102. Functions of a Complex Variable.—*Three times a week; both semesters. One unit.* Professor Townsend

104. Theory of Aggregates.—Modern treatment of the unrestricted set, correspondence, order, limit, neighborhood, measure, etc. *Three times a week; second semester. One unit.* Assistant Professor Blumberg

109. Algebraic and Abelian Functions.—Algebraic functions and their integrals on the Riemann surface. Abel's theorem and the inversion problem. Multiply periodic functions. Applications to the geometry on curves. Extensions to functions of two variables and the geometry on surfaces. *Three times a week; both semesters. One unit.* (Not given, 1921-22.) Professor Coble

110a. Elliptic Functions.—The processes of analysis on which the theory of elliptic function depends; singly periodic functions; etc. *Three times a week; first semester. One unit.* Professor Carmichael

110b. Elliptic Functions.—Approach to the theory of doubly periodic functions from the point of view of Weierstrass's product expansion, of q-difference equations, and of functional equations; etc. *Three times a week; second semester. One unit.* Professor Carmichael

111. Automorphic Functions.—Geometry in the complex plane. The group-theoretic side of the theory. Function-theoretic developments and applications of automorphic function. *Three times a week; both semesters. One unit.* (Not given, 1921-22.) Associate Professor Emch

112a. Linear Difference Equations.—Elementary theory of differences; equations with constant coefficients; etc. *Three times a week; first semester. One unit.* (Not given, 1921-22.) Professor Carmichael

112b. Linear Difference Equations.—General expansion problems. *Three times a week; second semester. One unit.* (Not given, 1921-22.)
Professor CARMICHAEL

113. Linear Differential Equations in Real Variables.—General existence theorems; oscillation theorems and pendulum problems; etc. *Three times a week; first semester. One unit.* (Not given, 1921-22.) Professor CARMICHAEL

114. Linear Differential Equations in Complex Variables.—General existence theorems, function-theoretic considerations; etc. *Three times a week; second semester. One unit.* (Not given, 1921-22.) Professor CARMICHAEL

122. Modern Algebra.—Theory of matrices, systems of linear equations, bilinear and quadratic forms, properties of polynomials, algebraic invariants. *Three times a week; both semesters. One unit.* Assistant Professor KEMPNER

124. The Theory of Numbers.—First semester: Theory of congruences, power residues with special study of quadratic residues and the law of reciprocity, and higher congruences. Second semester: Theory of algebraic numbers, domains of rationality, the theory of ideals. *Three times a week; both semesters. One unit.* (Not given, 1921-22.) Assistant Professor WAHLIN

126. Theory of Groups.—Introductory course. Substitution groups of low order, Sylow's theorem, etc. *Three times a week; both semesters. One unit.* (Not given, 1921-22.) Professor MILLER

127. Theory of Groups.—Advanced course. *Three times a week; both semesters. One unit.* Professor MILLER

129. Theory of Statistics.—General methods of statistical investigation; application to problems in economics, sociology and biology; graduation of frequency and other curves; correlation and contingency; limitations of the mathematical treatment of statistics; underlying assumptions and hypotheses. *Three times a week; both semesters. One unit.* (Not given, 1921-22.)
Assistant Professor CRATHORNE

131. Algebraic Surfaces.—The applications of homogeneous coordinates and the theory of invariants to geometry of three dimensions; etc. *Three times a week. One unit.* Associate Professor EMCH

132. Projective Geometry.—*Three times a week; both semesters. One unit.*
Professor COBLE

133. Geometric Transformations.—Motion in a plane; perspective; collineation; correlation; polarity; inversion, quadratic transformations; in particular the Steinerian transformation. Discussion of various transformations in space. *Three times a week; first semester. One unit.* (Not given, 1921-22.)
Associate Professor EMCH

134. Geometry in a Complex Field.—Geometric constructions in a complex plane; bilinear and higher algebraic transformations in a complex plane and their geometric interpretation. Geometric theory of associated point-couples, and its application. The treatment of imaginary elements in geometry. Theory of foci. Motion in a complex plane. *Three times a week; second semester. One unit.* (Not given, 1921-22.) Associate Professor EMCH

135. Differential Geometry.—Applications of the calculus to the theory of curves and surfaces based primarily on the use of Cartesian coordinates; relation of the theory of surfaces to the theory of invariants of a pair of quadratic differential forms. *Three times a week; both semesters. One unit.* Professor Coble

141. Vector Methods.—The algebras of quaternions, space and analysis, and dyadics; differentials and integrals of space; applications to mechanics, elasticity, hydrodynamics, electrodynamics, and meteorology. *Three times a week; first semester. One unit.* (Not given, 1921-22.) Professor Shaw

142. General Vectors.—The algebras applicable to space of four dimensions, and N dimensions; differential and integral operators; applications to relativity problems of kinematics, mechanics, electrodynamics; general dyadics and applications. *Three times a week; second semester. One unit.* (Not given, 1921-22.) Professor Shaw

143. Linear Algebra.—A general study of the theory of linear associative and non-associative algebras, particular consideration of the types of algebras, and their chief representatives; applications. *Three times a week; first semester. One unit.* Professor Shaw

144. General Algebra.—The general theory of combinations of elements, with a study of the main types such as associativity, commutativity, and other limitation types; applications to the theory of infinite algebras and the theory of general operators. *Three times a week; second semester. One unit.* Professor Shaw

145. Fundamental Functions.—The theory of orthogonal and biorthogonal functions and expansions in terms of them, with particular study of several well-known cases; applications to the solution of differential and integral equations. *Three times a week; first semester. One unit.* (Not given, 1921-22.) Professor Shaw

146. Functional Transformations.—The theory of operators which transform functions into functions, particularly those related to the infinite algebras of orthogonal functions; applications to functions of lines, surfaces, etc., and to integro-differential equations; general infinite vector analysis. *Three times a week; second semester. One unit.* (Not given, 1921-22.) Professor Shaw

Courses for Graduates and Advanced Undergraduates

10. Theory of Equations and Determinants.—*Three times a week; first semester.* Professor Miller

16-17. Differential Equations and Advanced Calculus.—*Three times a week; both semesters.* Professor Townsend

18. Constructive and Projective Geometry.—Methods of geometric constructions and constructive solution of problems. Approximative constructions. Discussion of possibilities of construction by ruler and compasses, by double-ruler, and instruments of higher order. Elements of inversive geometry in plane and space. Stereographic projection; isometric projection; orthographic projection; perspective; geometrical principles involved in projective processes; introduction to projective geometry. Analytic formulation of projective methods. *Three times a week; second semester. One unit.* Associate Professor Emch

21. Method of Least Squares.—*Twice a week; first semester.*
Professor STEBBINS

23. Averages and Mathematics of Investment.—Meaning, use, and abuse of averages; probability; annuities, insurance, and branches of science; loans and investments; evaluation of investment securities. *Three times a week; second semester.*
Assistant Professor CRATHORNE

30-31. Actuarial Theory.—Life contingencies; construction of life tables; valuation of policies; theory of risk; distribution of surplus; workmen's compensation; investment of funds; etc. *Three times a week; both semesters.*
Assistant Professor CRATHORNE

32. History of Mathematics.—*Twice a week; second semester.*
Assistant Professor LYTLE

35. Teacher's Course.—Secondary algebra and geometry; educational value; position in course; methods of teaching; correlation; American and foreign methods; order and importance of topics; text-books; literature. *Twice a week; first semester.*
Assistant Professor LYTLE

40. Fundamental Concepts of Mathematics.—Development of the number concept; concepts of unity; aggregate, order, and correspondence; irrationals and limits, transcendence of e and π ;etc. *Twice a week; second semester.* (Not given, 1920-21.)
Assistant Professor LYTLE

MECHANICAL ENGINEERING

The prerequisite for graduate work in mechanical engineering is the equivalent of the undergraduate course required for the degree of Bachelor of Science in mechanical engineering in the branches of the subject in which registration is desired.

Courses for Graduates*

107. Thermodynamics and Heat Motors.—General theory of thermodynamics with applications. *Twice a week; both semesters. One unit.*
Professor GOODENOUGH

109. Machine Design.—Rational design; mechanics of materials. Individual problems. *Twice a week; either semester. One unit.* Professor LEUTWILER

112. Laboratory Investigations.—Combustion of fuels, boiler economy, steam engines and turbines, and similar subjects. *Three times a week; both semesters. One and one-half units.* Professor WILLARD

MECHANICS, THEORETICAL AND APPLIED

The prerequisite for the courses for graduates in theoretical and applied mechanics is the equivalent of the undergraduate courses in theoretical and applied mechanics and in allied engineering subjects required for the degree of Bachelor of Science in engineering.

*Courses offered to Junior and Senior students are open for minor credit to students majoring in other departments.

Courses for Graduates

101. Analytical Mechanics.—The historical development of methods of analysis; advanced problems in statics and dynamics; a comparative study of texts. *Twice a week; first semester. One unit.* Professor MOORE

102. Resistance of Materials.—Analysis and investigation in mechanics of materials; the properties of materials used in engineering construction and the methods of determining these properties. *Twice a week; second semester. One unit.* Professor MOORE

103. Hydraulics and Hydraulic Engineering.—The laws of hydraulics, and their application to engineering problems; hydraulic power and its development; design and investigation. *Twice a week; second semester. One-half to one unit.* Professor ENGER

104. Experimental Work in Laboratory of Applied Mechanics.—(a) Laboratory investigation in the materials-testing laboratory; (b) experimental work in hydraulic laboratory. *Twice a week; both semesters. One-half to two units.* Professor TALBOT, Professor MOORE, Professor ENGER

105. Experimental and Analytical Work in Reinforced Concrete.—Research; interpretation of experimental results and their application to the design of structures; principles of construction. *Twice a week; both semesters. One to two units.* Professor TALBOT

Courses for Graduates and Advanced Undergraduates*

1. Analytical Mechanics.—Arranged for graduates and advanced undergraduates in Arts and Sciences. *Three times a week; first semester.* Assistant Professor ENSIGN

2. Analytical Mechanics.—A continuation of Theoretical and Applied Mechanics 1. *Three times a week; second semester.* Assistant Professor ENSIGN

41. Advanced Mechanics of Materials.—Special problems met in engineering. Thick cylinders, guns, curved beams, hooks, chain links, rings, unsymmetrical bending, flat plates, bulkheads; elastic strength of material as affected by heat treatment and over-strain; stresses due to impact loads; resistance of materials to repeated loading; collapsing pressure of thin-walled vessels. Exact versus approximate analyses. Methods of extending approximate analyses. General methods of attack. The application of mechanics to special machine parts and structures. *Three times a week; first semester.* Professor SEELY

42. The Properties of Engineering Materials; Specifications and Inspection.—The properties and uses of materials of construction, iron, steel, non-ferrous metals, wood, concrete, brick, and stone. Standard specifications for materials; methods of inspection. *Twice a week; second semester.* Professor MOORE

44. Laboratory Work in Testing Materials.—Study of testing machines and strain measuring apparatus; practise in making standard tests in tension, compression, and flexure. Torsion tests, impact tests, hardiness tests, repeated stress tests, and tests of special forms. Systematic tabulation and reduction of test data. Laboratory and computing room periods. This course is planned to serve those

*Courses offered to Junior and Senior students are open for minor credit to students majoring in other departments.

who wish to take positions in testing laboratories of the Government or of manufacturers. *Three times a week; second semester.* Professor Moore

45. Advanced Technical Mechanics.—A survey of graphical and algebraic methods and principles used in technical elastostatics. Graphostatical methods; string polygons; conjugate beams; graphical treatments of continuous beams; ellipses and circles of inertia, stress rigidity, and elasticity; stress and displacement diagrams. General theories of deformation of structures, in particular of statically indeterminate structures; principles of virtual work and of least action; the method of the substitute structure; the method of the principal displacements, including the slope-deflection method; Ritz's method; elastic stability and buckling. Applications to a variety of structures in different fields of engineering. *Three times a week; first semester.* Dr. Westergaard

METEOROLOGY

(See Geology)

MINERALOGY

(See Geology)

MINING ENGINEERING

The prerequisite for graduate work in mining engineering is the equivalent of the undergraduate courses required for the degree of Bachelor of Science in mining in the branches of the subject in which registration is desired.

In addition to the regular University laboratories, the laboratory connected with the investigation of mining conditions in Illinois now being carried on jointly by the Engineering Experiment Station through the Department of Mining Engineering, the State Geological Survey, and the United States Bureau of Mines, is available for graduate instruction.

Courses for Graduates

Note.—Of courses 103, 105, only one will be given, according to election of students.

100. Seminar.—*Once a week; both semesters. One unit.* Professor Stoek

101. Advanced Mining Methods.—Coal and ore fields of the United States; methods and economics of mining; utilization, marketing, storage, and transportation of coal and ores. *Twice a week; both semesters. One unit.* Professor Stoek

102. Advanced Preparation of Coal and Ores.—Detailed investigation and discussion of settling ratios; laws of crushing, sorting vs. sizing; specific mill and washing problems. *Twice a week; both semesters. One unit.* Mr. Arms

103. History of Miners' Organizations.—*Twice a week; both semesters. One unit.* (Not given, 1921-22.) Professor Stoek

104. Mining Reports.—Law of the apex, the classification of coal and ore lands; conservation of mineral resources; mine examination and report. *Twice a week; both semesters. One unit.* Professor Stoek

105. Welfare Work and Education Among Mine Employees.—The organization and operation of mining institutes, night classes, welfare, mine rescue, and first-aid work. *Twice a week; both semesters. One unit.* Professor Stoek

106. Advanced Coal, Ore, and Metallurgical Plant Design.—Flow sheets; general layout, design, estimates for constructions, and detailed specifications. *Twice a week; both semesters. One unit.* Assistant Professor Drucker

107. Advanced Non-Ferrous Metallurgical Projects.—Detailed investigations upon the treatment of zinc, lead, copper, gold, silver, and similar ores. Problems and reports. *Twice a week; both semesters. One unit.* Assistant Professor Drucker

Courses for Graduates and Advanced Undergraduates

8. Mine and Metallurgical Law, Administration, and Accounts.—Laws governing location, ownership, and policing of mines. Trade agreements, relations between employers and employees. Sociology. Accounts and cost sheets. *Twice a week; second semester.* Professor Stoek

9-19. Preparation of Coal and Ores.—History, principles, processes, machines; applications to dry coal preparation and coal washing. Breaking, sizing, and concentrating ores. Laboratory practise in coal washing. *Three times a week; first semester.* Assitant Professor Arms

17. Problems.—Problems, library research, and reports on mining and metallurgical subjects. *Once a week; first semester.* Assistant Professor Drucker

21. Mine Examination and Valuation.—The methods of examining, valuing, and reporting on mines, mining and metallurgical plants. Estimation and prospecting of mineral deposits. *Twice a week; first semester.* Professor Stoek

41, 43, 45. Principles of Mine and Metal Plant and Smelter Design.—Design of mine structures of wood, steel, and masonry, with drafting practise in design of coal tipples and general surface plant. *Three times a week; first semester.* Assistant Professor Drucker

42, 44, 46. Coal, Ore, Mill and Smelter Design.—General layout; design; estimates for construction and specifications for coal, ore, mill or smelter plant. *Twice a week; second semester.* Assistant Professor Drucker

64. Coal Mining Laboratory.—Different coals; their availability for crushing, dry preparation, washing, and briquetting. Complete commercial tests, using small commercial machines wherever possible; design of flow sheets; analysis of products. Estimation of probable costs. *Three times a week; second semester.* Assistant Professor Arms

66. Ore Concentration Laboratory.—Complete commercial wet and dry concentration tests on raw ores of lead, zinc, iron, etc. Amalgamation and cyanidation of a gold ore. Sampling, preparation, and analysis or assay of the products recovered. *Three times a week; second semester.* Assistant Professor Arms

MUNICIPAL AND SANITARY ENGINEERING

The prerequisite for graduate work in municipal and sanitary engineering is the equivalent of the undergraduate courses required for the degree of Bachelor of Science in municipal and sanitary engineering in the branches of the subject in which registration is desired.

Courses for Graduates

102. Water Supply Engineering.—Advanced work arranged to suit the requirements of individual classes. *One to three times a week; first or second semester. One unit.* Professor ENGER

103. Sewerage.—General sewerage design and construction; sewerage system; hydraulics of sewers. *Once or twice a week; second semester. One unit.* Professor ENGER

106. Water Purification, Sewage Disposal, and General Sanitation.—Design, construction, and operation of water purification plants and of sewage disposal works; water filters, sewage tanks, etc.; garbage disposal and general sanitation. *Once a week; second semester. Half unit or more.* Professor TALBOT

Courses for Graduates and Advanced Undergraduates*

6a-6b. Water Purification, Sewage Disposal, and General Sanitation.—Impurities in water supplies and methods and processes of removal; sewage disposal; purification plants; garbage collection and disposal; sanitary restrictions and regulations and general sanitation. *Three times a week; first semester. Twice a week; second semester.* Professor TALBOT, Assistant Professor BABBITT

ORIENTAL LANGUAGES AND LITERATURES

Courses for Graduates and Advanced Undergraduates

1. Elementary Hebrew.—Grammar and reading. The Book of Genesis. *Three times a week; both semesters.* Professor OLMSTEAD

2. Advanced Hebrew.—Readings in the sources for the early history. *Twice a week; both semesters.* (Not given, 1921-22.) Professor OLMSTEAD

10. Elementary Assyrian.—Grammar, sign lists, and reading. *Three times a week; both semesters.* Professor OLMSTEAD

PHILOSOPHY

Students entering on graduate work in philosophy must have had a general course in the history of philosophy, a course in logic, and a general course in psychology.

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*Other courses offered Senior students are open for minor credit to students majoring in other departments.

Courses for Graduates

103. Seminar in Ethics.—*Twice a week; first semester. One unit.*
Professor Daniels

107a. Plato and Aristotle.—*Twice a week; first semester. One unit.*
Associate Professor McClure

109. Contemporary Philosophy.—*Twice a week; second semester. One unit.*
Assoicate Professor McClure

Courses for Graduates and Advanced Undergraduates

3. History of Ancient and Medieval Philosophy.—*Three times a week; first semester.* Associate Professor McClure

4. History of Modern Philosophy.—*Three times a week; second semester.*
Associate Professor McClure

5. Political Philosophy.—A study of significant theories of the state, ancient, medieval, and modern; state sovereignty and morality with special reference to international relations. *Three times a week; second semester.*
Professor Daniels

7. Ethics.—The beginning and growth of morality; ethical theory; social and economic problems of the present. *Three times a week; second semester.*
Professor Daniels

9. Political and Social Ethics.—A study of the standards and principles of human conduct in political and social relations. Rights and duties of the state and the citizen. International morality. *Three times a week; first semester.*
Professor Daniels

11. Philosophy of Religion.—Among the topics considered are: God; revelation; inspiration; dogma; prayer; faith; immortality; the problem of evil; the relation of morality and religion. *Three times a week; first semester.* (Not given, 1920-21.)
Professor Daniels

15. British Philosophers of the Eighteenth Century.—*Three times a week; first semester.* Assistant Professor Lamprecht

PHYSICS

The prerequisite for graduate work in physics is a college course in general physics with a year's laboratory course in introductory physical measurements. The student who is to do major work in physics should also have had additional courses in physics or teaching experience, unless the training in his minor subjects, mathematics or chemistry, has been strong and complete. He should also have a knowledge of French and German sufficient to use references in these languages. The courses named below are those open for candidates for the master's or doctor's degree. A large part of the last year's work of the candidate for the doctor's degree is investigational, along either the experimental or the theoretical side of physics. In addition to these major graduate courses, the courses in elementary dynamics, heat, light, electrical measurements, and introductory electrical theory are

arranged with certain additions for the graduate credit. The intermediate courses on electricity and magnetism, heat, and light (Physics 15, 16, 17) may be offered with certain additions by candidates for the master's degree and then generally only as minors.

Courses for Graduates

104a-104b. Selected Problems in Electrical Measurements.—(a) Measurement of high and low resistances by refined methods; aperiodic and ballistic galvanometers; damping factor and critical damping resistance of a galvanometer; electric current and quantity; absolute determination of capacity; the Dolezalek quadrant electrometer; properties of dielectrics; the measurement of v and e—m for cathode rays; positive electricity; the potentiometer. (b) Refined methods of measuring the magnetic properties of iron; plotting of hysteresis curves and the determination of hysteresis losses; the Siemens electrodynomometer; the measurement of self- and mutual-induction by various methods including Hughes induction balance; the Braun discharge tubes in magnetic hysteresis; and the study of the characteristics of various forms of discharge tubes in the detection and amplification of electric waves. *Two times a week of three hours each; both semesters. Three-fourths unit.* (Course 104a is recommended for graduate students in chemistry.)
Professor Knipp

121. Recent Advances in Physics and the Electron Theory.—A series of demonstration lectures, in which members of the class will take turns in preparing and presenting experiments. The universal occurrence of electrons; properties of the electron, and of the gaseous ion; determination of e/m and v of the electron, and of the ion; use of positive rays (kanalstrahlen) in gas analysis; color effects of electrons, of ions, and of retrograde rays in residual hydrogen and helium; determination of the elementary charge of the electron. Once a fortnight; this will be in conjunction with 124. *Second semester. One-fourth unit.* Professor Knipp

123. Sound.—Advanced course on theory and experiments dealing with the production, transmission, and reception of sound. *Twice a week; both semesters. Either three-fourths unit or one unit* each semester. Professor Watson

124. Conduction of Electricity Through Gases.—A critical study of the phenomena of the conduction of electricity through gases. Lectures, recitations, and laboratory. Selected chapters from Townsend's *Electricity in Gases* and other texts. *Three times a week; first and second semesters. One unit.* Professor Knipp

126. Physics Colloquium.—Weekly meetings of the instructors and advanced students of the department for the presentation and discussion of papers on current problems in physics. Attendance is expected of all the graduate students. *Once a week; both semesters. No credit.*

127a. Problems of Present Theoretical Investigations in Physics.—*Twice a week; first and second semesters. One-half unit.* Associate Professor Kunz

131. Investigation of Special Problems.—*Two to four times a week; both semesters. One to two units.* Professors Carman, Knipp, Watson, Associate Professor Kunz, Assistant Professors Schulz, Williams

132. Mathematical Physics.—The complete list of courses in theoretical physics for 1920-21 will not be ready for announcement until September, 1920. Students

wishing such courses should get a list of additional courses at the time of registration.

132a. Dynamics.—Lectures on dynamics, special attention being paid to the general principles of dynamics, such as the principle of least action. Special problems are discussed, such as gyroscopic motion, the case of three attracting bodies, etc. The second part of the course will be devoted to hydrodynamics and aerodnamics. (Not given in 1921-22.) Associate Professor KUNZ

132b. Electrodynamics.—The potential theory applied to electrical and magnetic polarization; spherical harmonics, images and inversion, conjugate functions, elliptic coordinates and integrals, magnetic actions of currents, determination of coefficients of capacity, self and mutual induction, absolute measurements, Maxwell's theory with some applications in optics. *Four times a week; both semesters. One unit.* Associate Professor KUNZ

132e. Thermodynamics.—*Twice a week; second semester. One unit.* (Given in 1920-21 by Professor GOODENOUGH)

133. Seminar.—*Three or five times a week; both semesters. One to three units.* Professors CARMAN, KNIPP, WATSON, Associate Professor KUNZ, Assistant Professor SCHULZ

Courses for Graduates and Advanced Undergraduates

44a-44b. Electrical and Magnetic Measurements.—A comprehensive course in exact electrical and magnetic measurements, adapted for general and technical students. *Twice a week; both semesters.* Professor KNIPP

44a-44b. Electrical and Magnetic Measurements.—(Special section for graduate students of chemistry during the first semester.) *Twice a week; both semesters.* Professor KNIPP

14a. Introduction to Theoretical Physics.—Dynamics. Motion, mass, and force; problems from pure and applied physics. *Three times a week; first semester.* Professor CARMAN

***15. Electricity and Magnetism.**—(Recommended to students in non-technical courses who wish a knowledge of electricity and magnetism beyond the course in general physics.) *Two recitations or lectures and one three-hour laboratory exercise weekly; first semester.* Professor KNIPP

***16. Heat.**—Fundamental heat phenomena, the mechanical theory of heat, and elementary thermodynamics. Thermometry, calorimetry, vapor pressure, expansion of bodies, transmission of heat, mechanical equivalent. *Three times a week; second semester.* Professor WATSON

***17. Light.**—Reflection, refraction, interference, diffraction, and polarization; telescopes, microscopes, refractometers, prism and grating spectroscopes, and interferometers. *Three times a week; first semester.* Assistant Professor SCHULZ

20. Light.—Special phenomena; modern theories; readings in Drude, Week, and Preston. *Twice a week; second semester.* Assistant Professor SCHULZ

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*These courses may be taken for a minor credit or as *first* year major credit only.

22. Advanced Light Measurements.—Wave length determinations with gratings, echelons, and interferometers; spectroscopic work; Zeeman effect; polarimetric analysis; determination of resolving power of instruments; photometry and spectrophotometry. *Twice a week; second semester.* Assistant Professor SCHULZ

23. Sound.—Origin, propagation, velocity, and interference of sound; vibration of strings, rods, and gas columns; physical theory of music and speech. *Three times a week; first semester.* Professor WATSON

24. Properties of Matter.—Weight; mass; gravitation; elasticity; viscosity; surface tension; diffusion. Measurements including the use of the dividing engine, chronograph, etc. *Twice a week; second semester.* Assistant Professor WILLIAMS

27. Fundamental Physical Measurements.—An advanced laboratory course in measurements of length, mass, time and of determinations of gravitation, elasticity, surface tension, viscosity, etc. *Once or twice a week; second semester. One-half or one unit.* Assistant Professor WILLIAMS

30. Introduction to Theoretical Electricity.—Electrical and magnetic phenomena discussed with calculus methods. (For advanced students in physics, chemistry, mathematics, and engineering.) *Three times a week; second semester.* Professor KNIPP

33. Sound.—Laboratory experiments in fundamental phenomena in sound. The theory of sound as given in Physics 23 may be taken profitably with this course. *Once a week; first semester.* Professor WATSON

PHYSIOGRAPHY

(See Geology)

PHYSIOLOGY

The prerequisites for graduate work in physiology are physiology 1, 10a, and 2 or 4.

Courses for Graduates

101. Journal Club.—Review of literature. *Both semesters. One unit.* Associate Professor BURGE

102. Research.—*Both semesters.* Associate Professor BURGE

103. Special Phases of the Physiology of Respiration, Circulation, Digestion, Metabolism, Excretion, Secretion, Glands of Internal Secretion, Nervous System.—*Both semesters. One to two units.* Associate Professor BURGE

Courses for Graduates and Advanced Undergraduates

5. Physiology of Nutrition.—Foods, Vitamines, Exercise, Internal Secretions, Digestion and Metabolism as related to health, lowered vitality and disease. *Twice a week; second semester.*

Associate Professor BURGE, Assistant ————

7. Advanced Mammalian Physiology.—Operative technic in connection with secretions and excretions; a study of the glands of internal secretion and the reproductive system. *Three times a week; first semester.*
Associate Professor BURGE, Assistant ————

9. Physiology of Special Senses.—*Three times a week; second semester.*
Associate Professor BURGE, Assistant ————

POLITICAL SCIENCE

Graduate work in political science is conducted in the following special fields: (1) Political theory; (2) international law and diplomacy; (3) modern government; (4) constitutional law, administrative law, and jurisprudence; (5) municipal administration.

To be admitted to take political science as a major subject, the student must have done at least 18 hours of undergraduate work in political science, economics, and history, not less than nine hours of which have been in political science. To take political science as a minor he must have had at least nine hour's work in these fields, including six hours in political science.

If a student making political science his major is taking both of his minors in other departments, one of them must be in history, economics, or sociology.

Several courses given in other departments are so closely related to those in political science that graduate students whose major is political science may be permitted on petition to take such courses as part of their major work. Attention is also called to the technical courses given by the department of municipal and sanitary engineering.

Courses for Graduates

101. History of Political Theories.—Political theories of Aristotle, Machiavelli, Hobbes, Locke, Montesquieu, Rousseau, and others; evolution of American political ideas. *Twice a week; first semester. One unit.* Professor GARNER

102. The Nature of the State.—Principles, methods, and nature of political science; the origin, attributes, forms and functions of the state; sovereignty and liberty; citizenship and nationality; constitutions, their nature and forms; principles of legislative, executive, and judicial organization. *Twice a week; first semester. One unit.* (Not given, 1921-22.) Professor GARNER

103. Seminar in Political Science and Public Law.—Special problems; reports; discussions and criticism. The research work of candidates who are writing thesis is under the direction of some instructor to whom they report frequently. *Once a week; both semesters.* Members of the department.

104. Municipal Administration.—Selected topics in organization and special problems. *Second semester. One unit.* Associate Professor STORY

107. Foreign Relations of the United States.—Studies in the principles and practises of American foreign policy. *Twice a week; second semester. One unit.* (Not given, 1921-22.) Associate Professor MATHEWS

112. Public Administration.—Comparative studies in national and local administration and proposed changes. *Twice a week, second semester. One unit.*
Professor FAIRLIE

113. State Government and Administration.—Studies in the organization and methods of state governments in formulating and executing public policies. *Once a week; first semester. One unit.* Associate Professor MATHEWS

Courses for Graduates and Advanced Undergraduates

4. Municipal Government.—*Three times a week; first semester.*
Associate Professor STORY

5. Constitutional Law of the United States.—*Three times a week; first semester.*
Associate Professor MATHEWS

6a. International Law.—Law of Peace. *Three times a week; first semester.*
Professor GARNER

6b. International Law.—Law of War and Neutrality. *Three times a week; second semester.* Professor GARNER

7. American Diplomacy.—*Three times a week; second semester.*
Associate Professor MATHEWS

9. Principles of Jurisprudence.—The nature and sources of law; historical development and comparison of Roman law and the English legal system; English common law in the United States; relation between statutes and judicial decisions; classification of law. *Twice a week; first semester.* Professor FAIRLIE

10. Administrative Law in the United States.—Administrative organization; separation of powers and delegation of legislative powers; nature and scope of administrative power; administrative procedure and methods of enforcing governmental commands; remedies of the individual against unlawful official action. *Three times a week; second semester.* (Not given, 1921-22.)

11. Constitutional Aspects of Social and Industrial Problems.—The police power; constitutional limitations on legislation concerning the public health and safety; the control of public service corporations and combinations of capital and labor. *Three times a week; second semester.* Associate Professor MATHEWS

12. National Administration in the United States.—The President and the Cabinet; the executive departments and the administrative services of the national government. *Three times a week; second semester.* Professor FAIRLIE

13. State Administration in the United States.—*Three times a week; first semester.* Associate Professor MATHEWS

14. Political Parties.—Development of political parties and their organization and influence on the government mainly in the United States and Great Britain; recent legislation on primaries and nomination methods in this country. *Three times a week; first semester.* Dr. BERDAHL

18. Legislation in the United States.—Nature of legislative power; representation; legislative organization, procedure and practises; bill drafting; legislative reference bureaus; popular law making; tendencies in legislation. *Three times a week; second semester.* Associate Professor STORY

21. British Government.—Political institutions of Great Britain and the British dominions. *Twice a week; first semester.* Professor FAIRLIE

21a. Problems in British Government.—(Supplemental to Political Science 21) Special reports and conferences. *Once a week; first semester.*
Professor FAIRLIE

22. Continental European Governments.—The political systems of France, Germany, Italy, and Switzerland. *Three times a week; first semester.*
Professor GARNER

34. Municipal Problems.—Municipal administration in the United States and Europe; municipal organization and relations to the state; municipal ownership and regulation of public utilities; city planning and housing; police and sanitary administration; municipal finances. *Three times a week; second semester.*
Professor FAIRLIE

PSYCHOLOGY

Graduate students who elect psychology as their major subject must have had standard courses, of university grade, both in general psychology and in the psychological laboratory. One general university course is the minimal requirement for graduate students who apply to the department for a minor subject.

Courses for Graduates

103. Research.—Experimental and historical investigations. *Both semesters. One-half to two units.* Professor BENTLEY, Dr. RAHN

105. Seminar.—Current topics in their historical setting. *Once a week; two hours; both semesters. One unit.* Professor BENTLEY

Courses for Graduates and Advanced Undergraduates

5-6. Comparative Psychology.—Mind in the animal forms. *Twice a week; both semesters.* Dr. RAHN

9. Physiological Psychology.—The psychophysical relationships. *Three times a week; second semester.* Dr. RAHN

10. Translation of Psychological Treatises.—Reading and systematic interpretation of standard works in foreign languages. *Twice a week; first semester.*
Professor BENTLEY

12-13. Minor Problems.—Methods suitable to new problems. *Three times a week; both semesters.* Professor BENTLEY, Dr. GRIFFITH, Dr. SULLIVAN

14. Social Psychology.—The social mind, its factors and conditions; the psychology of peoples. *Three times a week; first semester.* Dr. RAHN

[**15. The Psychological Basis of Music.**—Development of melody, rhythm, and harmony; auditory phenomena pertaining to music; tests of musical aptitude. *Twice a week; second semester.* (Not given in 1921-22.)]
Associate Professor ————

[**16. Genetic Psychology.**—Instinctive responses; habits; development of mental functions in the child from birth to maturity. *Twice a week; first semester.* (Not given, 1921-22.)] Associate Professor ————

17. The History of Psychology.—*Twice a week; second semester.*
Dr. Griffith

18. The Psychology of Color.—*Twice a week; first semester.*
Dr. Griffith

20. Systematic Psychology.—*Three times a week; second semester.*
Professor Bentley

21-22. Special Studies.—Individual investigations for advanced students. *Three times a week; both semesters.* Professor Bentley, Dr. Rahn, Dr. Young

26. Recent Experimental Problems.—*Twice a week; first semester.*
Dr. Sullivan

RAILWAY ENGINEERING

The prerequisite for graduate work in railway engineering is the equivalent of the undergraduate courses required for the degree of Bachelor of Science in railway engineering in the branches of the subject in which registration is desired.

Courses for Graduates

102. Locomotive Design.—Steam pressure, compounding, superheating, etc. *Once a week; both semesters. One unit.* Professor Snodgrass

106. Locomotive Operation.—Train resistance and locomotive tractive effort; tonnage ratings. *Once a week; both semesters. One unit.* Professor Schmidt

108. Electric Railways.—Design, selection, and operation of electric railway equipment. *Once a week; both semesters. One unit.* Professor ————

110. Railway Location.—Effects of the location of a railway on its earning capacity; engineering and economic problems met with in original location; relocation and reduction of grades of existing lines. *Once a week; both semesters. One unit.*
Professor King

Courses for Graduates and Advanced Undergraduates

6. Locomotives.—*Four times a week; second semester.* Professor Snodgrass

33. Economic Theory of Railway Location.—*Four times a week; second semester.*
Professor King

64. Electric Railway Practise.—*Three times a week; first semester.*
Professor ————

74. Electric Railway Economics.—*Three times a week; second semester.*
Professor ————

RHETORIC

(See English)

ROMANCE LANGUAGES AND LITERATURES

Before entering upon the study of Romance Languages as a major for the degree of A.M., the candidate must have had at least (a) three years of college work in one Romance language, together with a satisfactory reading knowledge of another; or (b) two years of college work in each of two Romance languages. In either case a reading knowledge of German is highly desirable. Before being accepted as a recognized candidate for the degree of Ph.D., he must have had in addition satisfactory training in Latin, and must be able to read ordinary German prose. Before entering on the study of Romance languages as a first or second minor, the candidate must have had two years of college work in the language desired.

French

Courses for Graduates

101. Old French Epic Literature.—Reading and interpretation of the greater national and courtly epics; the history of these types of medieval literature. *Twice a week; both semesters. One unit.* (Not given, 1921-22.) Professor OLIVER

102. Old French Lyric and Prose Literature.—Interpretation of the earlier Old French didactic, chronicle, and lyric writers. *Twice a week; both semesters. One unit.* Professor OLIVER

103. Seventeenth Century Prose Writers.—French culture, society, and prose literature of the seventeenth century; great preachers and moralists; Jansenism and Port Royal; formation of the classic ideals. *Once a week; both semesters. One-half unit.* Professor OLIVER

104. Eighteenth Century Prose Writers.—Society, culture, and prose literature of the eighteenth century. The attack on the classic ideals; growth of the revolutionary spirit. *Once a week; both semesters. One-half unit.* (Not given 1921-22.) Professor OLIVER

127. French Romanticism.—Origin and development of the Romantic movement in France. *Twice a week; both semesters. One unit.* Professor CARNAHAN

Courses for Graduates and Advanced Undergraduates

10a-10b. General Survey of French Literature.—The main currents of French literature from the beginning to the present time. *Three times a week; both semesters.* Professor CARNAHAN

17a-17b. French Drama of the Nineteenth and Twentieth Centuries.—*Twice a week; both semesters.* Assistant Professor HAMILTON

24a-24b. French Drama of the Seventeenth and Eighteenth Centuries.—Corneille, Racine, Moliere, Voltaire, Marivaux, Sedaine, Beaumarchais. *Three times a week; both semesters.* Professor OLIVER

35a-35b. French Literature of the Sixteenth Century.—Marot, Ronsard, Du Bellay, Rabelais, Montaigne, the drama. *Twice a week; both semesters.* (Not given, 1921-22.) Professor MCKENZIE

42a-42b. The French Novel.—From 1850 to the present time. Lectures, reports, and collateral reading. *Twice a week; both semesters.* Assistant Professor HAMILTON

Italian

Courses for Graduates

140. Italian Literature of the Thirteenth and Fourteenth Centuries.—Dante, Petrarch, Boccaccio. *Twice a week; both semesters. One unit.* (Not given, 1921-22.)
Professor McKenzie

143. Italian Literature of the Fifteenth and Sixteenth Centuries.—*Twice a week. One unit.* (Not given, 1921-22.) Professor McKenzie

146. Modern Italian Literature.—*Twice a week; first semester. One unit.* (Not given, 1921-22.) Professor McKenzie

Course for Graduates and Advanced Undergraduates

3a-3b. Introduction to Italian Literature.—*Twice a week; both semesters.*
Assistant Professor Van Horne

Spanish

Courses for Graduates

132. The Novela of the Golden Age.—Political and social conditions in Spain from 1560 to 1700; the kinds of prose fiction produced in this period; *Don Quixote* and the *Novelas Exemplares* of Cervantes. *Twice a week; both semesters. One unit.*
Professor Fitz-Gerald

133. Origin of the Spanish Novela and of the Comedia.—The development of Spanish prose fiction and of Spanish dramatic art for the period previous to the Golden Age. *Twice a week; both semesters. One unit.* (Not given, 1921-22.)
Professor Fitz-Gerald

134. The Spanish Ballad.—Types of the ballad. *Twice a week; both semesters. One unit.* (Not given, - .)

137. Spanish Satire.—Development of satire in Spanish literature from the earliest monuments to the present. *Twice a week; both semesters.*

139. Spanish Literature in the Middle Ages.—Lectures on the history of Spanish literature from its origin through the reign of John II on Castile. *Twice a week; both semesters. One unit.* (Not given, 1921-22.) Professor Fitz-Gerald

Courses for Graduates and Advanced Undergraduates

10a-10b. General Survey of Spanish Literature.—*Twice a week; both semesters.* (Not given, 1921-22.)

11a-11b. Spanish Drama of the Sixteenth and Seventeenth Centuries.—Dramatists of the classical period; Lope de Vega, Calderon, Tirso de Molina, and Ruiz de Alarcon. *Twice a week; both semesters.* Assistant Professor Hamilton

17a-17b. Spanish Drama in the Ninteenth Century.—*Twice a week; both semesters.* Assistant Professor Van Horne

42a-42b. The Modern Novel in Spain.—Development of the novel in Spain from the middle of the nineteenth century to the present. *Twice a week; both semesters.*

ROMANCE PHILOLOGY

Courses for Graduates

171. Introduction to Romance Philology.—Historical phonology and morphology of the Romance languages. *Twice a week; both semesters. One unit.*
Professor FITZ-GERALD

175. Old French Phonology and Morphology.—Development of Old French from Vulgar Latin. *Once a week; both semesters. One-half unit.*
Professor OLIVER

179. Old Provencal.—Historical grammar; selected texts. *Once a week; both semesters. One-half unit.* (Not given, 1921-22.)

181. Origin and Formation of the Italian Language.—Thirteenth century tests. *Twice a week; second semester. One unit.* (Not given, 1921-22.)
Professor MCKENZIE

185. Oldest Monuments of the Spanish Language; Origins of Spanish Poetry—Historical grammar and paleography; interpretation of texts. *Twice a week; both semesters. One unit.* Professor FITZ-GERALD

191. Fables and Bestiaries.—History of animal literature, especially the medieval French and Italian collection. *Twice a week; second semester. One unit.* (Not given, 1921-22.) Professor MCKENZIE

195. Seminar.—Research work in preparation for theses in the field of Romance Languages. *Both semesters. One unit.* Members of the department

SCANDINAVIAN LANGUAGES

(See English)

SOCIOLOGY

Preparation for graduate work in sociology must include at least the equivalent of twelve semester hours in the social sciences, of which at least three must be in sociology, and three in the principles of economics. The remainder may be in any combination of these two subjects, or of history and political science.

Courses for Graduates

100. Bases of Social Theory.—*Twice a week; first semester. One unit.*
Professor HAYES

101. Sociological Method.—Adaptability to sociological investigation of methods described in Pearson's *Grammar of Science*, Wundt's *Methodenlehre, zweite abtheilung*, Seignobos' *La Methode Historique Appliquee aux Sciences Sociales*, Bernheim's *Historische Methode*, Spencer's *Study of Sociology*, and Giddings' *Inductive Sociology. Three times a week; first semester. One unit.*
Professor HAYES

102. The Development of Sociology.—*One session, two hours each week; both semesters. One unit.* Professor HAYES

150. Seminar.—Preparation of theses; detection and statement of problems. *One session of two hours each week; both semesters. One to two units.*

Professor HAYES

(Note: One of the three courses last described will be omitted in 1921-22; which one is omitted will depend on the election of students.)

Courses for Graduates and Advanced Undergraduates

3. Social Evolution.—The explanation of progressive social change, derived by applying the comparative method to ethnographic and historical materials relating to family organization, practical arts, economic wants and institutions, government and law, moral codes, and religions as they have appeared among savage, barbarous, and civilized peoples. *Three times a week; second semester.*

Professor HAYES

8. Charities.—The evolution of modern organized philanthropy, public and private; causes and prevention of poverty; organization and management of charitable institutions. *Three times a week; first semester.*

Assistant Professor SUTHERLAND

9. Criminology.—Nature, causes, and treatment of the criminal; evolution of modern methods of criminal procedure and penology; recent experiments and tendencies. *Three times a week; second semester.* Assistant Professor SUTHERLAND

10. Problems of Population.—*Three times a week; first semester.*

Assistant Professor SUTHERLAND

14. Methods of Social Research.—Social surveys; score-cards; individual case studies. *Three times a week; second semester.*

Assistant Professor SUTHERLAND

41. Labor Problems and Labor Organization.—(The same as economics 41.) *Three times a week; first semester.* Associate Professor WATKINS

42. Labor Legislation.—(The same as Economics 42.) *Three times a week; second semester.* Associate Professor WATKINS

43. Socialism and Economic Reform.—(The same as Economics 43.) *Twice a week; second semester.* Associate Professor WATKINS

ZOOLOGY

At least sixteen semester hours of college work in zoology are required for entering on major graduate study in this subject. Under special circumstances advanced work in closely allied subjects may be accepted in lieu of the fourth semester's work in zoology. When zoology is chosen for a minor the courses listed for graduates and undergraduates must be preceded by at least one full year's undergraduate work in zoology.

For the prosecution of graduate study in zoology a reading knowledge of German and French is indispensable and familiarity with Latin and Greek is of great advantage.

Every candidate for the doctor's degree is expected to spend at least one summer in study at the seashore. To facilitate this plan an investigator's room has

been provided at the Woods Hole Marine Biological Laboratory, where members of the department are afforded research facilities without cost to themselves. Application for the use of this room should be made to the head of the department early in the year. Similar facilities are afforded at the Harpswell Marine Laboratory.

Courses for Graduates

102. Vertebrate Morphology.—Origin of vertebrates and of the different classes; segmentation of the head; morphology of special systems. *Twice a week; first semester. One-half unit.* Professor ————

[**107. Parasitology.**—Structure and life history of animal parasites; their relations to disease; origin and biological significance of parasitism. *First semester. One unit each.* (Given in 1922-23 and in alternate years.)] Professor WARD

[**109-109a. Physiological Ecology.**—The regulatory mechanism of organisms; neutrality, osmotic pressure, immunity, and temperature in relation to natural environment. 109 *twice a week;* 109a assigned readings and reports. *Second semester. One-half unit each.* (Given in 1922-23 and in alternate years.)] Associate Professor SHELFORD

110-110a. Economic Ecology.—Application of principles of physiology and ecology to problems of fisheries and pollution; quantity and weather; forestry and conservation. 110 *twice a week;* 110a assigned reading and reports. *Second semester. One-half unit each.* (Given in 1921-22 and in alternate years.) Associate Professor SHELFORD

111. Experimental Ecology.—Repetition of published experiments in physiology and ecology, and study of modern methods and apparatus. *Both semesters. One-half to two units.* Associate Professor SHELFORD

115. Factors of Individual and Racial Development.—Experimental embryology; regeneration; heredity; variation; evolution. *Twice a week; both semesters. One unit.* Professor ZELENY

117. Faunistic Zoology.—Taxonomy and distribution, with especial reference to the local fauna; laboratory and field work. *Three times a week; first semester. One unit.* Professor SMITH

127. Theories of Animal Phylogeny.—Relations of various groups of animals; signification of so-called intermediate forms; invertebrate larval forms and theories of descent based on them. *Once or twice a week; both semesters. One unit.* (Given in 1921-22, and in alternate years.) Professor WARD

Individual Research Courses

121. Invertebrate Morphology and Parasitology.—*One to two units.* Professor WARD

122. Vertebrate Morphology.—*One to two units.* Professor ————

123. Faunistic and Systematic Zoology.—*One to two units.* Professor SMITH

124. Experimental Zoology.—*One to two units.* Professor ZELENY

125. Animal Ecology and Behavior.—*One to two units.* Associate Professor SHELFORD

Courses for Graduates and Advanced Undergraduates

8a-8b. Thesis Investigation.—Individual work on assigned topics. *Both semesters.* Various instructors

11. Experimental Ecology and Geography.—The physiology of environmental relations, facts, principles, and methods of analysis of behavior. World and regional aspects of behavior and ecology including animal distribution as related to climate and vegetation. Assigned readings and map making. *Two or four times a week; first semester.* Associate Professor SHELFORD

20a-20b. Current Investigations.—A critical analysis of the results of recent zoological investigations. (Must be taken by all graduate students majoring in Zoology.) *Once a week; both semesters.* Professor ZELENY

21a-21b. Introduction to Zoological Research.—Morphology, life-history, or reciprocal relations of invertebrate animals, especially parasitic forms. *Two to five times a week; both semesters.* Professor WARD

22-23. Morphology of Vertebrates.—Detailed studies of systems of organs from the comparative standpoint. *Twice a week; both semesters.* Professor ————

25-26. Experimental Zoology.—Experimental embryology; regeneration; heredity; variation; evolution. *Two to five times a week; both semesters.* Professor ZELENY

63. Ontogeny of Vertebrates.—Comparative studies of germ layers and early organogeny, with graphic and plastic reconstructions. Based chiefly upon Elasmobranchs and Amphibians. Open to seniors and graduates. *Two to four times a week; first semester.* Professor ————

66. Ontogeny of Vertebrates.—Studies of the development of selected systems or organs. Open to seniors and graduates. *Two to four times a week; second semester.* Professor ————

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4. The Illinois Biological Monographs, published quarterly. Three dollars a year.

5. The Journal of English and Germanic Philology, published quarterly. Three dollars a year.

For any of the above, address Room 156 Administration Building, University of Illinois, Urbana, Ill., U. S. A.

6. The Bulletin of the Agricultural Experiment Station. Address Director of Agricultural Experiment Station, University of Illinois.

7. The Bulletin of the Engineering Experiment Station. A report of the research work in the Engineering Experiment Station. Address Director of Engineering Experiment Station, University of Illinois.

8. The Bulletin of the State Laboratory of Natural History. Address Director of State Laboratory of Natural History, University of Illinois.

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11. The Report of the State Entomologist. Address State Entomologist, University of Illinois.

12. The Bulletin of the Illinois Association of Teachers of English. Address 301 University Hall, University of Illinois.

13. The Bulletin of the School of Education. Address 203 University Hall, University of Illinois.

14. The general series, containing the University catalog and circulars of special departments. Address the Registrar, University of Illinois.

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